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THREE ESSAYS ON THE SIGNIFICANCE OF CREDIT AND RISK ON THE REGIONAL LEVEL

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INTRODUCTION

Understanding the elements affecting bank lending rates is an important issue in those contexts, such as the Italian one, characterized by the large presence of small and medium enterprises for which bank credit is the main and almost unique source of funding.

During the nineties of the last century, the Italian banking system was interested of several legislative and regulatory changes that led to an increase in the degree of concentration and an improvement in the operating efficiency of the system. At the beginning of this period, almost the entire system was managed by the public sector, characterized by small or medium-sized banks and a limited degree of competition, efficiency and profitability.

After the privatization process concerning major Italian banks, the increasing level of competition in both national and international financial markets, the progressive deregulation of the banking activity, and following several merger and acquisition operations that determined an increase in the average size of all banks, the Italian banking system revealed an increase of efficiency and profitability together with a more ample range of financial services offered.

Particularly, the concentration process led to a substantial increase in the weight of the Central and Northern banks ownership in the Southern banks. Among the 89 acquisitions operations (period 1990-2000) completed in the Mezzogiorno, only 9 were associated to Southern banks resident in the same area (Daniele, 2003).

Several authors believe that, since the second half of the nineties, these processes have improved profitability and assets quality of all Southern banks[1].

[1] For example, Panetta (2003), analysing the accounting data of the Southern banks in 1990, 1995 and 2001, comes to at conclusion that, since the second half of the nineties, there has been, for these banks, a substantial improvement in the profitability indexes and, in opposite to the dynamics observed during the previous years, a significant reduction in the ratio of bad loans to total loans.

Nevertheless these improvements in the efficiency of the Southern banking system, lending rates charged to the customers operating in the Mezzogiorno area have remained considerable larger than those applied to Northern and Central borrowers[2].

Particularly, at the end of 2009, short-term lending rates from 1 to 5 years observed in Southern Italy and in the Islands were equal, respectively, to 5.19% and 4.30%, while the national average rate was equal to 3.40%.

Worse borrowing conditions penalize Southern firms' activities and, in this way, are able to hinder the local economic growth processes. It is hence necessary to understand the causes of these differentials.

The relevant question is if these spreads reflect objective and structural differences in the economic and banking system among regions or represent the result of a territorial discrimination based on exogenous and institutional factors.

To this purpose, this thesis develops an empirical analysis based on macroeconomic elements, at a regional and provincial level, and microeconomic factors at firm level.

In more details, this thesis is organized in three essays examining three different fields of research: the analysis of the determinants of interest rate spreads among the Italian provinces; the identification of the systematic and idiosyncratic elements influencing credit risk of the Italian firms; the relationship between institutional environment and the cost of money in Italy.

Particularly, in order to identify the crucial factors influencing lending rates at a macro level, taking into consideration the period 1998-2003, the first essay examines the causal relationships between the cost of money and the main characteristics of the banking system at a provincial level.

The second essay develops an analysis at microeconomic level. In order to identify credit risk's determinants, the second chapter estimates a set of probit

[2] The Mezzogiorno area comprises the Islands area (Sardinia and Sicily) and the regions of Southern Italy (Abruzzo, Basilicata, Calabria, Campania, Molise and Puglia).

panel models on the basis of the balance sheets of 10,058 Italian firms. Also the main macroeconomic features of the regions where firms operate are included in the models. Because credit risk is one of the main factors that banks assess in their credit policy, this element should contribute to explain the territorial spreads in the cost of money observed in Italy.

The results indicate that firms' credit risk is influenced by both idiosyncratic elements (such as firms' profitability, solidity and liquidity) and by the general conditions of the economic system.

The third essay intends to verify the possibility Southern borrowers pay higher lending rates because of specific features of the institutional environment in which they operate rather than structural economic and financial characteristics.

The previous empirical research has been concentrated on the relationship between social infrastructure and growth economic processes, while few contributions are focused on the effects of the institutional environment on the financial system (Guiso et al., 2004, Guiso, 2006 and Bonaccorsi di Patti, 2009). This aspect is crucial allowing to investigate if the increasing attention imposed by the Basel Accords on the objective relationship between capital requirements (and lending rates) and credit risk is actually implemented by Italian banks or if, instead, Southern firms must pay a larger cost of money nevertheless their actual risk of default.

The third essay indicates the institutional environment matters.

The results achieved show that the more cumbersome conditions applied to Southern borrowers are caused, together with elements concerning both credit demand and supply, also by the worse quality of the institutional environment in the Mezzogiorno area in terms of crime, corruption and inefficiency of the justice system.

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CHAPTER 1: THE INTERREGIONAL INTEREST RATE DIFFERENTIALS IN ITALY: THE EMPIRICAL EVIDENCE

1.1 Introduction

The aim of this chapter is to identify, on the basis of an analysis developed at a provincial level, the determinants of the differences in bank lending rates among the Italian areas.

The quantitative analysis is based on a balanced panel data sample concerning the main features of the economic and banking system in the 103 Italian provinces during the period 1998-2003.

The chapter is organized into five parts, beside this introduction. Paragraph 1.2 illustrates the main theoretical contributions examining the reasons of interregional interest rate spreads especially with reference – as regards the Italian context – to the different interpretations of Daniele (2003), Mattesini and Messori (2004) and the opinion of Bank of Italy, Panetta (2003).

Paragraph 1.3 illustrates the dynamics of bank lending rates and of other characteristics of the banking system in Italian provinces, pointing out that the differential of about 2 percentage points among Southern and Northern areas observed during the eighties of the last century has remained substantially unchanged until 2003.

Paragraph 1.4 describes the sample data and the methodology employed, while paragraph 1.5 develops an empirical analysis based on the estimation of a set of dynamic panel models. This analysis examines the relationships among interest rates and several financial variables (ratio of bad debts to total loans, number of branches every 10,000 inhabitants, the utilization rate ratio per average loan granted and average loans for branch) to identify the several and hypothetical causes of these spreads such as the differences in the size and industry

composition of the bank customers, or a different explanation concerning structural features of the economic and financial system.
Finally, the last paragraph summarizes the main results of the analysis.

1.2 Literature review

The literature on the regional differences in terms of cost of money, i.e. interest rate differentials, represents an old debate.
At the beginning, this topic was stressed among US economists, while Europeans' attention flourished in the last decades.
Particularly, among the causes of these differentials, the main theoretical contributions enumerated together with imperfections of financial markets also elements such as structural differences in the perceived borrowers' credit risk in different areas.
According to Keleher (1979), interregional interest rates differentials were not due to credit market segmentation in the United States (the author assumed that financial markets were integrated) but were imputable to the heterogeneity, in terms of costs and risk, of financial assets. Therefore, financial assets were not perfectly comparable.
Cebula and Zaharoff (1974) analysed the hypothesis of integrated financial markets in USA examining the responsiveness of financial flows (especially for deposits) to the differences, among regions, in terms of interest rates. The authors came to at conclusion that deposits were partially sensitive to interregional interest rate spread because of the gap among different areas in credit cost and risk.
Henderson (1944), Edwards (1965), James (1976) and Aspinwall (1979) demonstrated interregional interest rates spreads were due to the following causes:

- factors related to credit market structure, such as degree of concentration, number of financial institutions operating in the market and existence of interest rate ceilings;
- demand factors such as the diverse pressure on financial resources exerted in the different areas;
- differences in terms of risk concerning both the demand side (borrowers' credit risk) and the supply side (risk of banking default);
- regional differences in transaction costs due, primarily, to larger costs that banks must sustain to obtain information about the degree of borrowers' solvency in the peripheral areas.

  Interregional differences in transaction costs depend also on a "size effect" because of the existence of fixed costs in granting loans. In other words, the dimension of economies of scale is reduced if banks are constrained to finance small amount of loans to a pool of fragmented clients;
- spatial factors such as the distance from central financial markets: large distances, in fact, may reduce the quantity and the quality of information available to local economic agents.

Landon-Lane and Rockoff (2004) presented a different approach regarding how long regional financial markets in the USA became fully integrated. During the twentieth century the financial integration in the USA, i.e. the homogeneity across regions of interest rates, was paralleled by the economic integration of the American regions.

Galli and Onado (1990), observing the Italian context and, particularly, the regional interest rate spread between Northern regions and Mezzogiorno, pointed out that during the eighties of the last century, on average, bank lending rates in Southern Italy and in the Islands were above the national average respectively of 2 and 2.4 percentage points.

According to these authors spreads could be caused by the larger credit risk of Southern households and firms, together with some features of the Italian Mezzogiorno credit supply related to a lower efficiency and ability of the Southern banks to allocate financial resources in the area with respect to the Northern banks.

Finaldi Russo and Rossi (2000), analysing the cost and the credit availability for firms operating in the Italian industrial districts, emphasized how the localization affects lending rates. Particularly, firms operating in the Italian Mezzogiorno suffered higher costs and financial constraints with respect the ones operating in North and Central Italy.

Daniele (2003) emphasized the decisive role of the banking system, especially in those contexts characterized by a large presence of small and medium-sized firms. By analysing the main features of the Southern banking system during the period 1996-2001, the author noted that short-term lending rates observed in the Mezzogiorno were significantly higher than those applied in the other Italian regions. This situation hinders the regional economic development via higher interest rates, slowing capital accumulation, and therefore reducing the production capacity. Among the Italian regions, interregional interest rates differentials could be caused by the differences in terms of degree of concentration of the banking system, risk of loans granted and operating efficiency of banks. Furthermore, according to Daniele, a lower level of economic regional development (represented by a smaller value of the real GDP per capita), determines a higher credit risk and, therefore, the application of larger lending rates and a lower supply of loans. Moreover, the latter circumstance hinders the economic development determining a vicious circle between the level of economic development and the amount of credit available at local level.

Panetta (2003), taking into account the period 1986-2001, stressed that a part of the spread between the cost of bank credit to firms in the South and North Italy was only nominal. This portion reflected differences, among regions, in firms' size and industry structure. Particularly, by assuming the same firms' size and industry composition in all regions, according to Panetta, at the end of 2001, the gap between interest rates in the Mezzogiorno and North and Central Italy was about of 0.9 point percentages.

Panetta ascribed this further spread to the greater borrowers' credit risk in the Italian Mezzogiorno in comparison with the Central and Northern part of Italy. This situation reflected the structural difficulties of the Southern productive system and external diseconomies that burden on firms operating in the Mezzogiorno such as the large distance from final markets, the insufficiency of infrastructures and the inefficiencies of the bureaucratic apparatus. Moreover, higher lending rates in the Mezzogiorno might be partially explained by the limited degree of efficiency of judicial proceedings that could be activated in order to recuperate the granted credit in case of borrower's default. These proceedings seemed to be characterised in this area by a longer length to recuperate default loans, inducing banks to increase the required risk premium.

Also Beretta (2004) focuses on the importance to neutralize the effect of the differences, among areas, in terms of industry and size composition of the bank customers.

According to the author, during the period 1997-2003, lending rates are positively affected by the overall loans' riskiness, the degree of concentration in the loan market and the share of collateralized loans. Particularly, the latter element indicates that banks tend to apply more cumbersome lending conditions in the regions where the share of loans backed by collateral is higher because they consider this element such as a signal of greater ex-ante credit risk. Furthermore, the diffusion of the branch network on the territory, the incidence of loans supplied by local banks and the degree of branches' efficiency negatively influence the cost of money.

Mattesini and Messori (2004), analysing data concerning the Italian banking system for the period 1990-2000, underlined that, although since the second half of the nineties of the last century interregional differentials in the cost of money have been reduced, at the end of 2000 these spreads remained considerable.

The authors examined the dynamics of these differentials together with the bank consolidation process in the Southern banking system and came to at conclusion that the higher lending rates in the Italian Mezzogiorno were caused by the greater credit risk in the area that was been partially influenced by the aggressive policies of entry in the banking system adopted by the Northern and Central banks.

Furthermore, interregional interest rate differentials were due also to endogenous elements of the economic and financial system. Among these factors, authors emphasized the inadequacy of the Southern financial system that was not able to provide sufficient resources in order to support the economic development of the area. This inadequacy determined mechanisms of pressure inside the system causing, therefore, the application of greater interest rates to Southern households and firms.

In this framework, another important contribution is the analysis developed by Guiso (2006). Particularly, the author aspired to verify if the differences in credit availability and lending rates, among the Italian provinces, are affected, together with the firms' structural characteristics, also by institutional elements. Particularly, Guiso takes into consideration the following institutional variables (expressed at a provincial level): the inefficiency of the court system (measured by the number of civil suits pending per inhabitant), the level of social capital (expressed by the referenda turnout) and the ratio between illegal checks and GDP.

In details, to assess the territorial differences in credit availability, Guiso examines the results of the Mediocredito Centrale surveys that have been conducted in 1998 and 2000 on about 4,500 Italian firms. The author develops a set of probit models where the dependent variable is a limited variable that takes value 1 in case of credit rationing (the firm asked for a loan but its require has been totally or partially denied) and 0 otherwise.

The probability to observe credit rationing is positively affected by the firm leverage and the share of material assets. The latter element is explained by assuming that firms with greater material assets tend to chose riskier projects because risk aversion reduces as total wealth increases. On the contrary, the exclusivity degree of the relationship between bank and firm does not influence credit availability. As regards the institutional aspects taken into consideration by Guiso, the level of social capital and the degree of inefficiency of the court system negatively affect the probability to be credit-rationed, while the ratio between illegal checks and GDP does not significantly explain differences, among the Italian provinces, in credit availability.

The data on lending rates applied to the firms interviewed by the Mediocredito Centrale are obtained from Central Credit Register by calculating, for every firm, the average short-term lending rate applied during the fourth quarter of 2000.

According to the author, lending rates are negatively affected by the firm's age, size and profitability. Furthermore, banks tend to apply better borrowing conditions to subsidiary firms. On the contrary, sales growth, ownership concentration and the incidence of intangible assets positively influence lending rates. However, the firms' structural characteristics cannot explain the overall differences in the cost of credit between North and Central Italy and the Mezzogiorno.

As regards the features of the relationship between bank and firm, the length of the relationship and the territorial distance do not affect lending rates, while the cost of money positively depends on the degree of loan concentration and the share of collateralized loans (banks tend to require more collateral to riskier firms).

Finally, with reference to the institutional variables analyzed by Guiso, social capital and the number of civil suits pending per inhabitant negatively influence lending rates. The negative relationship between the cost of money and the degree of inefficiency of the justice system is explained, according to the author, by hypothesizing that banks use more restrictive screening criteria in the provinces where the average length of civil trials is higher. Consequently, in these areas, banks tend to finance firms characterized by a lower default risk.

On the whole, the work of Guiso points out that in Italy, in order to explain territorial differences in borrowing conditions, it is necessary to take into consideration also the institutional environment where firms operate. Indeed, the worse borrowing conditions observed in the Mezzogiorno depend on the lower quality of formal and informal institutions.

1.3 The empirical evidence

Between 1998 and 2003, short-term lending rates decreased considerably in all Italian regions. During this period, the greatest reduction occurred in the Islands where short-term lending rates declined by 3.02 percentage points from 9.49% to 6.47%, while in the other geographical areas the reduction of the cost of money was about 2 percentage points (see table A1.1).

The difference between the maximum and the minimum lending rate observed in Italian regions decreased from 4.17% in 1998 to 3.92% in 2003 (see table A1.2). Although this diminishing trend, the regional spread on borrowing conditions charged to economic agents continued to be large. At the end of 2003, lending rates in Southern Italy and in the Islands were, respectively, 2.16 and 1.47 percentage points above the national average value. In the same year, the difference between the largest and the smallest lending rate at provincial level was equal to 4.36%: the province with the highest lending rate – equal to 8.36% - was Vibo Valentia (in Calabria, in Southern Italy), while the province characterized by the best borrowing conditions was Bologna (in Emilia Romagna, in North-East Italy), with a provincial lending rate equal to 4.00%.

Data show that the substantial reduction of lending rates in Italian regions between 1998 and 2003 was not associated with a significant reduction of interregional differentials in the cost of money also in relative terms; on the contrary, the difference between lending rates charged in Southern regions and the national average values remained around 2 percentage points. The same values were observed by Galli and Onado during the eighties of the last century.

Although data on the cost of money are available up to the third semester of 2010, it is not possible to compare the values of lending rates before 2003 with those observed in the subsequent period because of the relevant changes introduced in the sample survey of deposit and lending rates by Bank of Italy at the beginning of 2004.

Because of this reason, the empirical analysis of the determinants of the interregional interest spreads in Italy will be based exclusively on the years 1998-2003.

In fact, by looking at the lending rates during after 2003, it is possible to notice that, in 2004, the cost of money is more homogenous among geographical areas.

In details, the interest rates applied in Southern Italy and in the Islands are greater than the national value just of about 50 basis points taking into consideration an initial period of rate fixation up to 1 year or more than 5 years. Only for the intermediate time horizon (from 1 to 5 years) the gap between lending rates charged in Southern regions and the national value was significant (less than 130 basis point) but lower than the spread observed in 2003 (see table A1.3).

Consequently, any comparison between these two different periods would be misleading. The sudden reduction of the spreads between 2003 and 2004 seems to be attributed to statistical causes and not to an actual improving of borrowing conditions in the Mezzogiorno area.

However, it is interesting to observe that also during the period 2004-2009, lending rates applied in Southern Italy and in the Islands were above the average national values.

By taking into consideration the lending rates at a provincial level during the period 1998-2003, an initial correlation analysis indicates that the cost of money is larger in the provinces characterized by a larger riskiness of loans (expressed in terms of ratio between bad debts and total loans), a greater value of the amount of credit used by borrowers relative to credit granted by the banking system, a lower diffusion of branches into the territory (measured by the number of branches every 10,000 inhabitants) and a smaller value of average loans for branch (see table A1.4).

The provinces whose banking system is characterized by these features are localized in the Mezzogiorno area. This element indicates, consistently with the main literature, that interregional spreads in the cost of money can be explained by looking at the differences in the structure of the banking system among areas.

During the nineties of the last century, in Italy, the aggregation processes among banks led to a substantial increase in the degree of concentration of the banking system. Particularly, between 1990 and 2000, in the Italian banking system there were 229 acquisitions operations; nevertheless, while in the Northern Italy these acquisitions occurred, almost exclusively, in the same area, in the Italian Mezzogiorno only 9 out of 89 were effectuated by banks with legal residence in Southern regions.

These events caused, between 1990 and 2003, a drastic reduction in the number of banks in the Mezzogiorno where, on the whole, banks decreased by 58 units. This diminution occurred largely from 1997 to 2003, when the number of banks operating in Southern Italy decreased by 42 units.

As regards the number of banks every 10,000 inhabitants, during the same period, the value of this indicator in Southern Italy and in the Islands was lower than the value observed in North-West and Central Italy denoting, thereby, a lower degree of competition of the banking system in Southern regions. In order to adequately assess the degree of competition of the banking system, it would be necessary to compute an indicator, such as the Herfindahl-Hirschman index, for each area. Nevertheless, because data on banks' market share are not publically available, the territorial diffusion of the bank network (expressed by the number of banks or branches per 10,000 inhabitants) can be considered a proxy of the banking system's structure and, indirectly, of the degree of competition. This approach is consistent with the analysis developed by Bank of Italy (Bonaccorsi di Patti, 2009) that examines the relationship between credit availability and institutional environment in Italy and includes the number of branches per 1,000 inhabitants as a measure of spatial competition.

Under the same conditions, a lower degree of competition could have led to a worsening of borrowing conditions applied to bank customers because of possible gains in the market power for banks involved. Nevertheless, the examined data do not support the hypothesis of a significant relationship between the degree of competition of the banking system and the cost of money (the correlation coefficients between the number of banks every 10,000 inhabitants and lending rates is equal to -0.11).

The lack of a significant correlation between the degree of competition and the cost of money can be caused by several factors.

First, the increase in the degree of concentration of the Italian banking system may not be associated with a contemporaneous boost in the market power of the banks originated via the merger and acquisition procedures. This hypothesis might be confirmed by the expansion of the branch network that occurred contemporaneously with the reduction of the number of banks and that was facilitated by the deregulation process that, during the nineties of the last century, eliminated the territorial constraints to banking activity.

Nevertheless, although during the period examined the number of branches increased in all areas, in 2003, in Southern regions the degree of territorial diffusion of branches remained noticeably lower in comparison with the other ones. In details, in Southern Italy and in the Islands there were, respectively, 3.10 and 3.53 branches per 10,000 inhabitants, a value less than the number observed, in the same year, at national level (5.27).

Second, the lack of a significant relationship between the degree of concentration and the cost of money can be due to the possible gains in the operating efficiency that mergers and acquisition may have determined for the Italian banking system. According to Angelini and Cetorelli (2000), banks involved in concentration operations during the nineties, exhibited considerably lower marginal costs than other banks and, therefore, they were able to apply better borrowing conditions (in terms of lending rates) to all customers.

Data show the presence of a negative relationship between operation size and the cost of money (the correlation coefficient between average loans for branch and lending rates is equal to -0.51). In addition, the level of average loans for bank in Southern Italy and in the Islands (equal, respectively, to 0.937 and 1.267 millions of euros) were lower than the value observed, on average, in Italy (1.381 millions of euros).

These data seem to indicate that larger size of loans should allow the Northern banks to apply better credit conditions given larger economies of scale. In order to verify this hypothesis, it would be interesting also to analyse microeconomic factors and examine, for example, micro and accounting data concerning the degree of innovation for each bank. However, data about these elements are not publically available.

Another factor to explain interregional interest rate spread is the degree of "gap" of the banking system expressed in terms of utilization rate ratio per average loan granted. This indicator can be considered as a proxy for a spatial credit rationing because it relates actual satisfied credit demand with respect to credit supply granted. Values of the index greater than 1 denote the presence of potential credit crunch in the system because borrowers actually need an amount of credit greater than the amount granted and, hence, the banking system is not be able or not willing to satisfy the local economic agents' credit demand.

Table A1.5, in appendix 1.1, shows that the utilization rate ratio was substantially stable in each macroarea. In 2003, this index took the highest value in Calabria, where it was equal to 85.0% (at national level, in the same year, the utilization rate ratio amounted to 72.3%).

Finally, it is necessary to compare lending rates with the different perceived borrowers' credit risk in the areas. This element can be expressed, in a macro perspective, through the ratio between bad debts and total loans, while at a micro level, the probability of default is a better indicator.

Data show that during the period 1998-2003 the loans' riskiness in the regions of the Italian Mezzogiorno was significantly higher than that observed in Northern and Central areas.

During this period, the weight of bad debts to total loans decreased in all provinces. Southern Italy and the Islands were the geographical areas with the most substantial improvement of credit quality and, inside these areas, Sicily registered the highest reduction in the ratio of bad debts to total loans (from 34.8% in 1998 to 13.5% in 2003).

Although these positive results, at the end of the period taken into consideration, in Southern regions this indicator remained considerably higher with respect the national average value (in 2003, this ratio amounted, respectively, to 12.3%, 13.1% and 4.9% in Southern Italy, in Islands and, on average, in Italy). These data denote, hence, the existence of a positive relationship between the cost of money and riskiness of loans.

In order to evaluate the determinants of interregional interest-rate spreads, it is important to consider also the different levels of economic development of the areas.

The more intuitive proxy for this element is the level of GDP per capita, under the hypothesis that the areas with a larger value of this indicator are characterized also by a greater level of economic development.

However, data on GDP per capita are not available at a provincial level but only at a regional level. Hence, it is necessary to consider another proxy for local development.

Because the added value is strictly correlated to the GDP (the added value of an economy is the difference between total production and the value of the productive factors used into the productive phases), it appears appropriate to use the added value as a proxy for provinces' total wealth. Hence, the added value per capita can be considered as a proxy of the degree of economic development, while the added value for employed represents a measure of the productivity of the economies.

Data show that worse borrowing conditions are associated to lower levels of added value per capita and added value per effective labour unit (the correlation coefficient between these indicators and lending rates amount, respectively, to -0.76 and -0.70).

Furthermore, data show that the provinces more developed in terms of added value per capita are characterized also by a greater degree of territorial diffusion of branches, a larger banks' operating size and a better credit quality (see table A1.4).

The correlation matrix between the characteristics of the provincial economic and banking systems illustrated in this paragraph is shown in table A1.4. This matrix can be considered as a tool to choose relevant factors that can contribute to explain differences in the cost of money across the provinces, as well as to identify possible multicollinearity problems between the explanatory variables in a regression framework.

1.4 Data and methodology

In order to identify the causes of the heterogeneity in bank interest rates among the Italian provinces, this work develops a quantitative analysis based on a set of balanced panel data concerning the main features of the economic and banking system in Italian provinces during the period 1998-2003.

As I pointed out in paragraph 1.3, because of problems of data homogeneity, it is not possible to consider data concerning the cost of money after 2003. In fact, since 2004, data relating to interest rates are not comparable with those referred to the previous period because of the changes introduced in the quarterly sample survey of deposit and lending rates by Bank of Italy. Particularly, the new survey, applied since the first quarter of 2004, is based on a larger number of banks and on a modified report form. All comparisons are therefore not homogeneous.

The following section examines the relationship among the cost of money (expressed in terms of short-term lending rates on loan facilities up to 18 months) and several macroeconomic and financial variables that can influence the level of provincial lending rates.

Short-term lending rates at provincial level have been estimated by the Guglielmo Tagliacarne Institute on the basis of the regional lending rates calculated by Bank of Italy according to the national sample survey developed at regional level[3].

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[3]According to section 2.3 of the methodological appendix of the Statistical Bulletin published by Bank of Italy in the last quarter of the period object of analysis:

"Pursuant to Article 51 of the Banking Law, two groups of banks participate in the quarterly survey of interest rates: around 70 banks for lending rates and 60 for deposit rates. Both groups include the principal banks at national level. The information on lending rates refers to the rates charged to resident non–bank customers reported to the Central Credit Register in the last month of the reference quarter, provided the related loans and guarantees exceed the reporting threshold.

For each name and with reference to each reporting category, banks must report the interest products and the amount received or debited for interest, commissions and fees. On the basis of these data, interest rates are calculated as the weighted average of the effective rate charged to customers, according to the formula:

These data represent the most reliable estimates of provincial lending rates that are available and the estimation methodology has been positively verified by Bank of Italy staff.

The necessity to use provincial data is due to the limited number of observations (and, hence, of degrees of freedom) that would characterize an analysis based on regional data. In fact, if this analysis would be based on regional data, the number of observations for each variable would be equal to 120 (observations about 20 regions for 6 years). The possibility to consider provincial data noticeably increases the number of observations, improving the significance and the robustness of the whole analysis (for every variable, it is in fact possible to take into consideration 618 observations, i.e. data on 103 provinces for 6 years).

The variables employed in the analysis and potentially able to affect regional lending rates are, on the basis of the correlation analysis previously developed, the ratio of bad debts to total loans, the number of branches per 10,000 inhabitants, the utilization rate ratio (per average loan granted) and the level of average loans for branch.

As regards the ratio of bad debts to total loans and the utilization rate ratio, it is necessary to consider that the numerator and the denominator of these indicators are characterized by different temporal dynamics; in fact, for each year, both bad debts and the amount of credit actually used refer to loans granted in previous years. Therefore, for each year, the ratio of bad debts to total loans was calculated as the ratio between the amount of bad debts during the year in question and the amount of total loans concerning the previous year. Analogously, the utilization rate ratio is computed as the ratio between the

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*r(%) = amounts due*36.5/products*

This weighted average is used for the data on interest rates published in the Bulletin unless otherwise specified in the notes to the tables".

amount of credit actually used by borrowers during the year taken into consideration and the total amount of credit granted during the previous period.
Data concerning the financial system are elaborated by Bank of Italy, with the exception of data on lending rates that, as pointed out before, are provided by Guglielmo Tagliacarne Institute; data on population are elaborated by the Italian National Statistical Office (ISTAT).
As regards the riskiness of loans, this analysis does not take into account also the quarterly default rates for loan facilities defined by Bank of Italy as "*the ratio whose denominator is the amount of credit used by all the borrowers covered by the Central Credit Register not classified as "adjusted bad debtors" at the end of the previous quarter and whose numerator is the amount of credit used by such borrowers who become "adjusted bad debtors" during the quarter in question*"[4].
Because of the considerable volatility of default rates, I preferred to include in the analysis the ratio of bad debts to total loans as proxy of granted loans' riskiness. The high volatility of default rates would have biased the results of this work.
An important element to verify is the stationarity of the variables included in the model. Generally, in order to evaluate the hypothesis of stationarity of panel series, the literature has proposed several tests based on different assumptions. Particularly, the most important unit root tests for panel data are those introduced by Im, Pesaran and Shin (1997), Maddala and Wu (1999) and Levin et al. (2002).

[4] Bank of Italy defines adjusted bad debts as "*the total loans outstanding when a borrower is reported to the Central Credit Register: a) as a bad debt by the only bank that disbursed credit; b) as a bad debt by one bank and as having an overshoot by the only other bank exposed; c) as a bad debt by one bank and the amount of the bad debt is at least 70% of its exposure towards the banking system or as having overshoots equal to or more than 10% of its total loans outstanding; d) as a bad debt by at least two banks for amounts equal to or more than 10% of its total loans outstanding*".

Among these tests, I took into consideration the Im, Pesaran and Shin test (henceforth IPS test) and the Maddala and Wu test (henceforth MW test) because these two tests explicitly consider heterogeneity among groups[5]. This element seems to be very important in this analysis where the individual units are the Italian provinces, whose economic and banking structure is rather different. The test introduced by Levin and Lin, on the contrary, by assuming common unit root processes, does not allow this possibility.

Furthermore, the IPS test and the MW test are more appropriate to evaluate the stationarity in micro-panel samples, with *T* fixed.

The results are shown in appendix 1.1. According to these tests, we cannot reject the null hypothesis of not stationarity for the following series: loans for bank, loans for branches, added value per effective labour unit and added value per capita. On the contrary, lending rates, the number of banks and branches per 10,000 inhabitants, the utilization rate ratio, the ratio between bad debts and total loans and the growth rate of the added value are stationary series. However, all variables are I(1), i.e. if the series are expressed in terms of first differences, these tests lead to the rejection of the null hypothesis of not stationarity[6].

In light of the above considerations, the econometric analysis is based on a set of dynamic panel models that analyze the statistical relationship between lending rates and the financial and macroeconomic variables mentioned above.

The econometric models employed to identify the elements that, at a macro level, affect the cost of money, have been estimated through the methodology introduced by Arellano and Bond in 1991. In fact, it is clear that the causal relationships hypothesized have a dynamic and not static nature. This

[5] The criterion used to choose the number of lags included into the autoregressive equations that have been employed to verify the null hypothesis of unit root is the Schwarz Info Criterion.

[6] As regards the ratio between bad debts and total loans expressed in first differences, according to the MW test it is not possible to reject the null hypothesis of not stationarity.

specification allows hence to take into consideration the degree of persistence that characterizes borrowing conditions at provincial level.

Among the dynamic panel models, the choice of the Arellano and Bond methodology is justified by three reasons. First, because the Arellano and Bond method is a procedure based on the moment conditions, its use allows to overcome possible endogeneity problems of the regressors; second, because the instrumental variables used through this method are expressed in first differences, the Arellano and Bond procedure allows to overcome the problem of not stationary of several regressors that are, however, I(1); third, the Arellano and Bond procedure leads to consistent estimates, for micro-panel samples, where there are a large number of individuals (*N*) observed over a short period of time (*T*).

1.5 The econometric analysis

The following analysis shows that the worse borrowing conditions in Southern provinces can be caused by factors concerning the structure of the banking system.

In order to understand the effect of the banking structure on lending rates at regional level, the Arellano and Bond methodology is employed to estimate a set of dynamic panel models that examine the relationship between interest rates and the financial variables previously indicated.

The explanatory variables of these models have been chosen by taking into consideration both the main results of the literature about the elements able to influence the cost of money at macroeconomic level and the results of the correlation analysis previously developed.

It would be appropriate to have an exact measure of the degree of concentration of the banking system in every province, given the general positive relationship between concentration and price pointed out by the structure-conduct-performance paradigm. However, in order to build up an indicator of the degree of concentration of the banking system it would be necessary to analyse data on banks' market shares. Because these data are not available, it is not possible to compute an indicator of this type. The dataset used in this work, however, gives us an implicit measure of the degree of competition of the banking system, because the diffusion of the branch network on the territory is generally positive correlated with the degree of competition of the system.

According to the previous analysis, the factors potentially able to explain the different levels in the lending rates among the areas are:

- operating size of branches, expressed in terms of average loans for branch;
- diffusion of the branch network on the territory, measured by the number of branches per 10,000 inhabitants;
- degree of tension in the banking system, expressed in terms of utilization rate ratio;
- riskiness of loans, calculated as ratio between bad debts and total loans;
- degree of economic development, approximated by the amount of added value per capita;
- degree of productivity in the system, measured by the amount of added value per effective labour unit.

Obviously, it is not possible to insert all these variable in a single model because of the significant correlation relationships between them that would cause multicollinearity problems. In fact, by looking at table A1.4, it is possible to notice as the added value per capita and the added value per effective labour unit are highly correlated with the other variables. Hence, these two variables are not included into the regression models.

As regards the other variables, the most significant correlation is observed between the ratio of bad debts on total loans and the number of branches per 10,000 inhabitants (the correlation index between these two indicators amounts to -0.77). Therefore, in order to avoid multicollinearity, these two variables cannot be included into the same models.

Nevertheless, as pointed out by Baltagi (2008) and Hsiao (2003), in panel data models the multicollinearity problems are substantially reduced, given the more degrees of freedom and information on individual attributes that panel data offer. Hence, I decided to not include, in the same model, variables for which the correlation coefficient is, in absolute value, bigger than 0.4.

I estimated 16 specifications that are characterized by different assumptions on the nature – strictly exogenous or predetermined – of the explanatory variables.

In order to analyze the effects of the structure of the banking system on lending rates, the estimated dynamic panel models include, among the regressors, the average loans for branch, the utilization rate ratio and, separately, the ratio of bad debts to total loans (from model 1 to model 8) and the number of branches per 10,000 inhabitants (from model 9 to model 16). The results are shown in appendix 1.1 (tables A1.7 and A1.8).

Because of the limited number of periods taken into consideration in the analysis (6 years), the inclusion of a number of lags greater than 2 would significantly reduce the degrees of freedom and the robustness of the estimates.

Furthermore, because of the high degree of persistence that characterizes lending rates (that is caused also by the imperfections in the banking system that cause sluggish adjustments in lending rates), every model includes 2 lags for the dependent variable.

Three cross-sections are lost in constructing lags and taking first differences, so that the estimation period is 2001-2003 and the number of useable observations for each series is equal to 309.

Each model has been evaluated on the basis of the Wald test, the Sargan test and the Arellano and Bond test in order to assess the consistency of the estimated coefficients.

The Wald test verifies the joint significance of the coefficients associated to the regressors[7].

The Sargan test verifies the hypothesis that the overidentifying restrictions are valid, i.e. the validity of the instruments employed in the regression.

Finally, the Arellano and Bond test verifies the lack of second-order serial correlation among the residuals of the regression, i.e. $E[v_{it}v_{i(t-2)}] = 0$[8]. This condition represents a crucial assumption of the Arellano and Bond methodology and if it is not respected the estimated coefficients are inconsistent because, in this case, there exists a significant correlation between the regressors included into the matrix of instruments and the idiosyncratic component of the error.

All models have been estimated through the one-step and the two-steps Arellano and Bond methodology (the results are shown in tables A1.7 and A1.8). However, as suggested by Arellano and Bond, because for samples of small size the two-steps standard errors are downward biased, it is preferable to make inference based on the one-step estimator.

The results, confirm the consistency of the estimated coefficients. In fact, with the exception of three specifications (model 2, 3 and 7), the results of the Arellano and Bond test indicates that it is not possible to reject the null hypothesis of the lack of second-order serial correlation among the residuals of the regression. Furthermore, for all the models, the Wald test rejects the hypothesis that the estimated coefficient are not jointly significantly different from zero.

Among the models for which the Arellano and Bond test does not reject the null hypothesis, the Sargan test leads to do not reject the hypothesis of validity of the instruments only for two specifications (model 8 and 15). In these two models,

[7] Under the null hypothesis of not joint significance of the estimated coefficients, the probability distribution of the Wald test is a chi-square with a number of degrees of freedom equal to the number of the regressors.

[8] See appendix 1.2 for more details about the Sargan test and the Arellano and Bond test.

the ratio between bad debts and total loans, the average loans for branch and the utilization rate ratio are considered as predetermined while the number of branches every 10,000 inhabitants is considered as strictly exogenous. These results imply that it could be not appropriate to treat the features of the banking system included in the models as strictly exogenous because some shock could influence the future changes in these elements.

The regression output indicates that, after controlling for the persistence in the lending rates series, borrowing conditions remain significantly affected by the regional banking structure.

The sum of the coefficients associated to the lagged values of the dependent variable is always less than 1; the stationarity condition is therefore respected.

Lending rates are negatively affected by the average branches' operating size and of the territorial diffusion of the branch network.

Particularly, under the same conditions, if average loans for branch increase of 1 million of euros, lending rates reduces of 51 basis points, according to model 8, or 42 basis points according to model 15; an increase of 1 branch per 10,000 inhabitants leads to a reduction of 162 basis points in lending rates (model 15).

The results seem to confirm that the general augment in banks' operating efficiency caused by the increase in their average operating size was be able to offset the possible gains in banks' market power due to the aggregation processes.

Consequently, the lower branches' operating size (and, hence, the smaller degree of banks' efficiency) and the smaller degree of spatial closeness between banks and firms in Southern Italy and in the Islands, represent one of the causes that determine worse borrowing conditions in these areas.

Also the degree of diffusion of the branch network in the territory affects the cost of money. Under the hypothesis that a greater number of branches per 10,000 inhabitants implies a larger degree of competition in the banking system, the negative and significant relationship between this variable and lending rates is consistent with the structure-conduct-performance paradigm.

The smaller number of branches per 10,000 inhabitants in Southern provinces (and, hence, the more implicit concentration of the banking system in these zones) contributes hence to determine a larger cost of money in Southern Italy and in the Islands.

Another factor causing higher interest rates in Southern areas is the worse credit quality. Credit risk represents one of the main elements that banks take into account in their credit and pricing policies. While at microeconomic level credit risk is usually expressed in terms of probability of default, in a macro perspective the regional ratio of bad debts to total loans can be used as a proxy of borrowers' credit risk.

The results are consistent with the theory: a greater degree of borrowers' riskiness determines the application of higher bank interest rates. In detail, according to model 8, an augment of 1% in the ratio of bad debts to total loans is associated with an increase of 11 basis points in lending rates.

According to models 8 and 15, the utilization rate ratio does not significantly influence lending rates.

The lack of a significant relationship between these two variables can be due to the greater homogeneity of the utilization rate ratio across the areas in comparison with the other explanatory variables.

Particularly, in 2003, this index was equal, in Southern Italy, in the Islands and at national level, respectively, to 80.7%, 81.8% and 72.3% (table A1.5).

In conclusion, these models show that the differences among regions in lending rates can be explained by taking into consideration the differences in terms of banking structure and borrowers' behaviour. Larger branches operating in Northern regions, by exploiting bigger scale economies, are able to apply to their customers better borrowing conditions.

Another reason why banks apply larger lending rates in Southern regions is the larger loans' riskiness that characterizes this area. On the other hand, this pricing policy can cause adverse selection phenomena in credit market and, consequently, increases the average regional credit risk determining a vicious circle between higher lending rates and larger borrowers' risk.
The higher cost of money in Southern provinces represents a crucial element because worse borrowing conditions are able to hinder the regional economic development, slowing investments and the capital accumulation process.
It is important to analyze the structure of the banking system in those contexts, such as the Italian one, in which bank credit is the main (and in the most part of the cases the only) source of funding for private firms. The structural characteristics of the banking system, among which the worse borrowing conditions observed in Southern areas, can have large effects on the real economic system, by hindering the level of economic development.
Furthermore, the difficulties that Southern firms face to obtain bank credit, can obstruct also their innovation ability and, hence, their productivity. This situation prevents improvements in Southern economy's competitive level, a necessary condition to overcame the structural crisis that, for several decades, have burden on the Southern areas.

1.6 Conclusions

The causes of interregional interest rate differentials observed in several countries represents a topic, for a long period, object of debate in economic literature. Among the different reasons, several authors enumerate together with imperfections of financial markets also real and economic variables. Particularly, literature tends to explain these spreads through factors concerning credit market's structure, regional differences in transaction costs, demand, borrowers' localization and according to the differences, across the areas, in the perceived counterparts' credit risk.

In Italy the difference of about 2 percentage points between lending rates charged in Southern regions and the national average, observed on average during the eighties of the last century, remained substantially unchanged until 2003.

A school of thought assumes that the higher lending rates in Southern regions are due, mainly, to the differences among areas, in the size and industry composition of bank customers, and the lack of infrastructures adequate to support economic growth (Panetta, 2003).

A second view, instead, considers that the higher lending rates charged in the Italian Mezzogiorno can be due, primarily, to the greater riskiness of loans observed in the area and other factors such as a credit rationing strategy occurred in the Italian Mezzogiorno because of the inadequacy of the Southern financial system, not able to provide financial resources sufficient to sustain local development processes (Mattesini and Messori, 2004).

The endogenous nature of the causes of interregional interest rate spreads was confirmed, as regards the American context, by the analysis developed by Landon-Lane and Rockoff in 2004. The American financial system achieved a high degree of financial integration (and, therefore, interregional interest rate differentials decreased) only after the second post-war, when the American economic system became more homogeneous.

As regards the Italian case, the results of this work are partially in contrast with Panetta's opinion. In order to understand why, in Southern areas, banks apply greater lending rates, before looking at the differences in the size and industry composition of borrowers, it is necessary to take into consideration the differences, among areas, in the banks' structural characteristics.

The analysis developed indicates, in fact, that during the period 1998-2003 in Southern Italy and in the Islands the larger cost of money was caused by several structural factors such as the lower average branches' size and the smaller territorial diffusion of the branch network.

The operating size of branches (expressed in terms of average loans for branch) negatively influences bank interest rates because of the ability of large-sized branches to achieve greater levels of efficiency (by exploiting scale economies) and, hence, under the same conditions, to charge lower lending rates to the counterparts.

The smaller degree of diffusion of branches in the territory observed in the Mezzogiorno (measured by the number of branches per 10,000 inhabitants) denotes a lower degree of competition in the area and hence determines worse borrowing conditions.

Consistently with Panetta's results, however, this analysis shows the existence of a significant and positive relationship between borrowers' riskiness (measured by the ratio of bad debts to total loans) and the cost of money. Hence, a share of the interregional interest rate spreads in Italy is caused by the higher borrowers' riskiness perceived in Southern Italy and in the Islands.

However, the higher riskiness in these areas can be caused by adverse selection phenomena in the credit market (in other words, by the same application of worse borrowing conditions). Therefore, it is important to understand if the higher riskiness in Southern regions measured by the larger ratio of bad debts to total loans reflects the borrowers' structural characteristics or if it is caused by market imperfections.

This topic is very important in the light of the restraining effect of worse borrowing conditions on the degree of economic development.

1.7 References

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Appendix 1.1: Tables

Table A1.1. Short-term lending rates on loan facilities up to 18 months (1998-2003) – IV quarter.

	1998	1999	2000	2001	2002	2003
Piedmont	6.56	5.11	6.59	6.18	5.98	5.52
Valle d'Aosta	8.20	6.69	8.10	7.82	6.43	6.54
Liguria	7.62	6.07	7.32	6.95	6.75	5.97
Lombardy	6.17	4.63	6.07	5.48	5.06	4.50
Trentino Alto Adige	7.25	5.71	7.17	6.43	5.96	4.57
Veneto	7.15	5.86	7.25	6.76	6.60	5.38
Friuli Venezia Giulia	6.80	5.56	7.23	6.79	6.73	5.39
Emilia Romagna	6.49	5.17	6.69	5.85	5.79	4.55
Marche	6.95	5.18	6.53	6.24	5.99	5.12
Tuscany	7.14	5.60	6.87	6.61	6.59	5.62
Umbria	8.56	6.81	7.90	7.49	7.17	6.39
Lazio	7.57	6.01	6.87	6.19	5.80	5.24
Abruzzo	8.60	6.37	7.56	7.56	7.05	6.64
Molise	9.37	8.16	9.02	8.20	8.29	8.01
Campania	8.52	7.25	8.39	8.00	7.63	7.34
Puglia	8.47	6.61	8.47	7.85	7.43	6.77
Basilicata	9.32	7.85	8.76	8.29	6.97	7.04
Calabria	9.81	7.04	9.90	9.37	8.64	8.01
Sicily	9.52	6.96	8.27	7.63	7.87	6.92
Sardinia	9.44	7.50	8.98	7.90	6.97	5.57
North-West Italy	6.32	4.80	6.22	5.66	5.28	4.70
North-East Italy	6.86	5.54	7.02	6.34	6.25	4.99
Central Italy	7.40	5.80	6.86	6.35	6.10	5.39
Southern Italy	8.69	7.02	8.48	8.04	7.59	7.16
Islands	9.49	7.13	8.46	7.70	7.59	6.47
Italy	6.70	5.30	6.64	5.91	5.73	5.00

Source: Bank of Italy data.

Table A1.2. Dispersion indexes of short-term lending rates on loan facilities up to 18 months (1998-2003) – IV quarter.

Indexes	1998	1999	2000	2001	2002	2003
Maximum	11.55	8.34	9.01	9.67	8.54	8.64
Minimum	7.38	4.81	5.42	6.15	5.15	4.72
Range	4.17	3.53	3.59	3.52	3.39	3.92
Max./Min.	1.57	1.73	1.66	1.57	1.66	1.83

Source: elaborations on Bank of Italy data.

Table A1.3. Lending rates on loan facilities - Distribution by geographical area and initial period of rate fixation – IV quarter.

	2004	2005	2006	2007	2008	2009
	Initial period of rate fixation up to 1 year					
North-West Italy	4.01	3.85	5.05	6.05	6.24	3.05
North-East Italy	4.00	3.92	5.14	6.15	6.23	3.03
Central Italy	4.12	4.05	5.19	6.15	6.40	3.32
Southern Italy	4.64	4.47	5.75	6.63	7.03	3.93
Islands	4.57	4.38	5.50	6.50	6.74	3.70
Italy	4.10	3.98	5.18	6.16	6.36	3.20
	Initial period of rate fixation from 1 to 5 years					
North-West Italy	3.05	3.05	3.93	5.07	4.65	2.66
North-East Italy	3.41	3.52	4.46	5.53	4.98	3.98
Central Italy	3.95	3.72	4.25	4.69	4.93	3.49
Southern Italy	4.70	4.53	5.11	5.83	6.19	5.19
Islands	4.53	4.58	5.19	6.01	5.94	4.30
Italy	3.43	3.35	4.15	5.05	4.89	3.40
	Initial period of rate fixation more than 5 years					
North-West Italy	5.04	4.49	4.85	5.35	5.44	4.40
North-East Italy	4.65	4.65	5.07	5.30	5.31	4.72
Central Italy	5.34	5.04	5.13	5.17	5.08	4.76
Southern Italy	5.78	5.23	5.22	5.42	5.61	5.42
Islands	5.78	5.24	5.26	5.56	5.68	5.15
Italy	5.28	4.90	5.07	5.29	5.32	4.79

Source: Bank of Italy data.

Table A1.4. Correlation matrix.

	Rates	Loans for bank	Loans for branch	Branches per 10,000 inh.	Banks per 10,000 inh.	Utilization rate ratio	Bad debts on total loans	Added value per effect. labour unit	Added value growth	Added value per capita
Rates	1.0000									
Loans for bank	-0.2680	1.0000								
Loans for branch	**-0.5058**	0.3508	1.0000							
Branches per 10,000 inh.	**-0.6135**	0.0299	0.1676	1.0000						
Banks per 10,000 inh.	-0.1122	-0.3513	-0.0152	0.4286	1.0000					
Utilization rate ratio	**0.3786**	-0.2210	-0.1956	-0.3402	0.0376	1.0000				
Bad debts on total loans	**0.6719**	-0.2313	-0.4025	-0.7684	-0.2004	0.3369	1.0000			
Added value per effect. Labour unit	**-0.6958**	0.3605	0.6338	0.5596	0.0789	-0.3486	-0.6519	1.0000		
Added value growth	0.0374	-0.0247	0.0271	0.0139	0.0173	0.0901	-0.0477	0.0178	1.0000	
Added value per capita	**-0.7587**	0.2896	0.6199	0.8081	0.2197	-0.4367	-0.8231	0.8388	0.0250	1.0000

Source: elaborations on Bank of Italy, ISTAT and Guglielmo Tagliacarne Institute data.

Table A1.5. Loans for bank, loans for branch, banks and branches per 10,000 inhabitants, utilization rate ratio and bad debts on total loans in Italian regions (1998-2003) (*).

	Loans for bank		Loans for branch		Banks per 10,000 inhabitants		Branches per 10,000 inhabitants		Utilization rate ratio		Bad debts on total loans	
	1998	2003	1998	2003	1998	2003	1998	2003	1998	2003	1998	2003
Piedmont	1.991	2.648	0.027	0.032	0.07	0.07	5.24	5.92	0.631	0.660	0.045	0.032
Valle d'A.	0.343	1.070	0.016	0.022	0.34	0.16	7.20	7.95	0.786	0.724	0.077	0.035
Liguria	1.882	3.046	0.018	0.024	0.05	0.04	5.15	5.73	0.658	0.763	0.102	0.052
Lombardy	1.093	1.808	0.038	0.056	0.20	0.19	5.65	6.32	0.672	0.681	0.050	0.026
Trentino	0.106	0.212	0.017	0.027	1.52	1.19	9.34	9.48	0.770	0.727	0.029	0.018
Veneto	0.948	1.703	0.022	0.030	0.14	0.12	6.10	7.03	0.710	0.750	0.061	0.027
Friuli V.	0.472	0.906	0.019	0.024	0.26	0.20	6.49	7.69	0.719	0.740	0.053	0.028
Emilia R.	1.056	1.872	0.026	0.033	0.16	0.13	6.60	7.71	0.724	0.705	0.050	0.046
Marche	0.580	0.934	0.020	0.026	0.19	0.19	5.70	6.93	0.757	0.768	0.089	0.043
Tuscany	0.789	1.130	0.024	0.032	0.17	0.17	5.44	6.22	0.799	0.812	0.077	0.036
Umbria	0.687	0.986	0.022	0.024	0.16	0.15	5.04	6.18	0.866	0.905	0.094	0.062
Lazio	1.750	2.259	0.064	0.063	0.14	0.13	3.87	4.62	0.786	0.739	0.102	0.064
Abruzzo	0.474	1.066	0.020	0.023	0.17	0.10	3.89	4.77	0.767	0.744	0.166	0.078
Molise	0.368	0.833	0.016	0.018	0.15	0.09	3.47	4.35	0.778	0.789	0.202	0.128
Campania	0.515	1.210	0.023	0.026	0.11	0.06	2.40	2.62	0.796	0.818	0.159	0.096
Puglia	0.670	0.990	0.020	0.022	0.08	0.07	2.82	3.30	0.825	0.829	0.246	0.147
Basilicata	0.231	0.568	0.018	0.019	0.28	0.13	3.57	4.05	0.845	0.736	0.246	0.184
Calabria	0.230	0.519	0.019	0.021	0.18	0.10	2.20	2.52	0.905	0.850	0.276	0.180
Sicily	0.521	0.974	0.018	0.020	0.11	0.07	3.23	3.36	0.737	0.812	0.348	0.135
Sardinia	2.844	3.831	0.018	0.023	0.02	0.02	3.86	4.07	0.841	0.829	0.160	0.123
NW Italy	1.232	1.959	0.033	0.046	0.15	0.14	5.49	6.16	0.662	0.680	0.052	0.028
NE Italy	0.527	0.984	0.023	0.030	0.28	0.23	6.61	7.58	0.722	0.726	0.053	0.034
Centr. Italy	1.153	1.528	0.039	0.042	0.16	0.15	4.71	5.57	0.789	0.767	0.095	0.055
South. Italy	0.449	0.937	0.021	0.023	0.13	0.08	2.70	3.10	0.808	0.807	0.202	0.123
Islands	0.678	1.267	0.018	0.021	0.09	0.06	3.39	3.53	0.771	0.818	0.296	0.131
Italy	0.805	1.381	0.028	0.036	0.16	0.14	4.61	5.27	0.721	0.723	0.093	0.049

Source: elaborations on Bank of Italy and ISTAT data.

(*) *Data on loans for bank and loans for branches in millions of euros.*

Table A1.6. Unit Root Tests. (*)

Variable	Im, Pesaran and Shin test: Statistic	Prob.	Cross-section	Obs.	Maddala and Wu test: Statistic	Prob.	Cross-section	Obs.
Variables in levels								
Rates	-8.47688	0.0000	103	515	447.214	0.0000	103	515
Loans for bank (**)	5.58647	1.0000	98	489	131.818	0.9999	98	489
Loans for branch	4.3293	1.0000	103	515	152.439	0.9980	103	515
Branches per 10,000 inhab.	-1.70116	0.0445	103	515	259.289	0.0069	103	515
Banks per 10,000 inhab.	-17.4007	0.0000	100	500	332.106	0.0000	100	500
Utilization rate ratio	-1.74845	0.0402	103	515	252.348	0.0152	103	515
Bad debts on total loans	-3.03909	0.0012	103	515	288.559	0.0001	103	515
Added value per effect. labour unit	7.39455	1.0000	103	515	95.7767	1.0000	103	515
Growth added value	-2.93266	0.0017	103	515	276.972	0.0007	103	515
Added value per capita	6.63933	1.0000	103	515	87.9608	1.0000	103	515
Variables in first differences								
Rates	-19.5178	0.0000	103	412	603.361	0.0000	103	412
Loans for bank (**)	-8.43061	0.0000	98	391	313.187	0.0000	98	391
Loans for branch	-4.93867	0.0000	103	412	255.032	0.0113	103	412
Branches per 10,000 inhab.	-9.18273	0.0000	103	412	277.519	0.0007	103	412
Banks per 10,000 inhab.	-78.3189	0.0000	100	400	456.388	0.0000	100	400
Utilization rate ratio	-11.4062	0.0000	103	412	402.553	0.0000	103	412
Bad debts on total loans	-2.72856	0.0032	103	412	223.998	0.1855	103	412
Added value per effect. labour unit	-9.41922	0.0000	103	412	347.556	0.0000	103	412
Growth added value	-11.7518	0.0000	103	412	389.207	0.0000	103	412
Added value per capita	-6.85408	0.0000	103	412	295.117	0.0000	103	412

Source: elaborations on Bank of Italy, ISTAT and Guglielmo Tagliacarne Institute data.
(*) The null hypothesis of the Im, Pesaran and Shin test and Maddala and Wu test assumes individual unit root processes for each province.
(**) For the variable "loans for bank", IPS and MW tests are based only on 98 cross-section because, during the period 2000-2003, there were no banks in the following provinces: Isernia (in Southern Italy), Nuoro (in the Islands), Imperia, Pavia and Vercelli (in North-West Italy). Consequently, it is not possible to calculate this indicator for 5 provinces out of 103.

Table A1.7. Regression output – one-step estimation (dependent variable: short-term lending rates).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Rates								
L1.	0.360***	0.348***	0.171*	0.472***	0.324***	0.362***	-0.013	0.239**
	(4.53)	(4.66)	(1.84)	(5.49)	(3.82)	(4.84)	(-0.10)	(2.55)
L2.	0.236***	0.172***	0.144**	0.284***	0.192***	0.185***	0.084	0.170**
	(4.24)	(3.17)	(2.16)	(4.79)	(3.11)	(3.40)	(1.00)	(2.52)
Baddebts/Totalloans								
--	0.130***	***0.201****	0.036	0.146***	***0.117****	***0.194****	0.00008	***0.107****
	(6.49)	***(8.28)***	(1.49)	(6.92)	***(4.10)***	***(7.96)***	(0.00)	***(3.43)***
Branches								
--								
Loans/Branches								
--	-0.298***	-0.285***	***-0.535****	-0.293***	***-0.483****	-0.280***	***-0.590****	***-0.505****
	(-15.80)	(-14.77)	***(-17.81)***	(-15.16)	***(-16.76)***	(-14.70)	***(-14.34)***	***(-15.48)***
Used/Granted								
--	0.021***	0.021***	0.028***	***0.042****	0.028***	***0.025****	***-0.025***	***-0.008***
	(4.03)	(3.83)	(4.41)	***(5.72)***	(4.46)	***(3.89)***	***(-2.08)***	***(-0.91)***
Cons	7.326***	6.953***	15.439***	4.438***	12.054***	6.372***	22.933***	16.230***
	(5.92)	(5.93)	(9.82)	(3.10)	(8.52)	(5.25)	(8.51)	(9.06)
Wald test	484.56	466.31	446.05	432.30	468.79	468.60	303.58	398.75
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sargan test	212.79	172.17	22.62	171.41	23.81	171.28	8.56	16.15
Prob > chi2	0.0000	0.0000	0.0071	0.0000	0.0135	0.0000	0.6628	0.2412
AB2 test	1.923	1.967	2.139	1.500	1.864	1.943	2.080	1.923
Prob > z	0.0545	0.0492	0.0325	0.1336	0.0623	0.0520	0.0375	0.0541

Table A1.7 (continued) – one-step estimation.

	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16
Rates								
L1.	0.514***	0.580***	0.300***	0.552***	0.423***	0.583***	0.185	0.326***
	(7.84)	(8.40)	(3.99)	(8.29)	(5.02)	(8.40)	(1.45)	(3.16)
L2.	0.296***	0.292***	0.185***	0.320***	0.246***	0.296***	0.143**	0.219***
	(6.29)	(5.99)	(3.50)	(6.75)	(5.05)	(6.03)	(2.02)	(3.97)
Baddebts/Totalloans								
--								
Branches								
--	-2.870***	***-3.964******	-1.770***	-2.872***	***-2.429******	***-4.030******	-1.624***	***-1.935******
	(-15.33)	***(-16.10)***	(-7.34)	(-15.05)	***(-4.14)***	***(-16.11)***	(-4.25)	***(-2.84)***
Loans/Branches								
--	-0.195***	-0.131***	***-0.381******	-0.187***	***-0.294******	-0.124***	***-0.420******	***-0.353******
	(-10.83)	(-6.32)	***(-13.00)***	(-10.50)	***(-4.83)***	(-5.96)	***(-6.49)***	***(-4.89)***
Used/Granted								
--	0.012***	0.005	0.018***	***0.016******	0.014*	***0.0002***	***-0.021***	***-0.006***
	(2.74)	(1.09)	(3.53)	***(2.82)***	(2.42)	***(0.04)***	***(-1.55)***	***(-0.99)***
Cons	20.676***	25.181***	21.197***	19.822***	21.621***	25.719***	25.518***	22.832***
	(19.93)	(20.64)	(18.46)	(17.35)	(12.41)	(19.42)	(10.92)	(13.72)
Wald test	836.89	789.62	749.01	806.18	867.78	775.60	528.03	715.46
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sargan test	113.83	51.45	27.99	119.91	50.97	52.97	12.65	39.96
Prob > chi2	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	0.3169	0.0001
AB2 test	-0.004	-0.121	1.590	-0.196	0.734	-0.138	1.918	1.172
Prob > z	0.9964	0.9041	0.1119	0.8446	0.4629	0.8904	0.0551	0.2413

Source: elaborations on Bank of Italy, ISTAT and Guglielmo Tagliacarne Institute data.

Notes: The values highlighted in bolditalics refer to predetermined variables, while the other values refer to strictly exogenous variables. The values in brackets are the values of the z-statistic. *** variable significant at the 1%, ** at the 5%, * at the 10%.

Table A1.8. Regression output – two-steps estimation (dependent variable: short-term lending rates).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Rates								
L1.	0.336***	0.335***	0.083	0.457***	0.310***	0.337***	-0.069	0.194**
	(4.05)	(5.23)	(1.00)	(5.85)	(4.00)	(5.27)	(-0.60)	(2.26)
L2.	0.199***	0.153***	0.114**	0.229***	0.188***	0.149***	0.073	0.144***
	(4.05)	(3.77)	(2.36)	(4.47)	(4.23)	(3.71)	(1.31)	(3.30)
Baddebts/Totalloans								
--	0.133***	***0.189****	0.00003	0.166***	***0.097***	***0.190****	-0.024	***0.098***
	(3.85)	***(4.66)***	(0.00)	(5.32)	***(2.41)***	***(4.81)***	(-0.72)	***(2.27)***
Branches								
--								
Loans/Branches								
--	-0.336***	-0.320***	***-0.587****	-0.317***	***-0.502****	-0.321***	***-0.626****	***-0.503****
	(-9.07)	(-11.00)	***(-12.46)***	(-9.42)	***(-11.81)***	(-10.90)	***(-10.95)***	***(-11.72)***
Used/Granted								
--	0.016**	0.021**	0.031***	***0.039****	0.026***	***0.023***	***-0.012****	***-0.003***
	(1.99)	(2.52)	(3.31)	***(3.14)***	(2.88)	***(2.25)***	***(-0.77)***	***(-0.31)***
Cons	8.697***	7.855***	17.304***	5.251***	12.869***	7.726***	23.414***	16.416***
	(5.40)	(5.81)	(9.43)	(3.36)	(7.07)	(5.81)	(7.34)	(8.03)
Wald test	322.94	248.26	244.16	343.24	286.49	263.05	206.35	278.82
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sargan test	40.66	42.46	13.10	42.04	19.35	47.51	10.11	17.39
Prob > chi2	0.0000	0.0000	0.1582	0.0000	0.0550	0.0000	0.5202	0.1820
AB2 test	1.992	2.024	2.462	1.615	1.953	2.045	2.369	2.211
Prob > z	0.0464	0.0429	0.0138	0.1064	0.0508	0.0409	0.0179	0.0270

Table A1.8 (continued) – two-steps estimation.

	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16
Rates								
L1.	0.522***	0.636***	0.274***	0.578***	0.429***	0.634***	0.176*	0.346***
	(7.89)	(9.70)	(3.62)	(8.95)	(6.40)	(9.72)	(1.84)	(4.21)
L2.	0.262***	0.280***	0.149***	0.281***	0.222***	0.277***	0.117**	0.200***
	(6.11)	(6.91)	(3.51)	(6.97)	(6.38)	(7.00)	(2.40)	(5.21)
Baddebts/Totalloans								
--								
Branches								
--	-2.891***	***-4.075****	-1.704***	-3.008***	***-2.159****	***-4.119****	-1.673***	***-2.048****
	(-10.60)	***(-13.92)***	(-5.93)	(-11.82)	***(-4.42)***	***(-14.13)***	(-5.03)	***(-3.63)***
Loans/Branches								
--	-0.196***	-0.116***	***-0.398****	-0.186***	***-0.321****	-0.111***	***-0.421****	***-0.331****
	(-8.12)	(-6.27)	***(-9.00)***	(-8.31)	***(-6.26)***	(-5.92)	***(-8.06)***	***(-5.69)***
Used/Granted								
--	0.010*	0.003	0.021***	***0.020****	0.015**	***0.002***	***-0.007***	***0.002***
	(1.90)	(0.75)	(3.05)	***(2.79)***	(2.39)	***(0.31)***	***(-0.69)***	***(0.40)***
Cons	21.654***	26.417***	21.567***	21.009***	21.635***	26.646***	25.181***	22.940***
	(16.08)	(17.36)	(16.02)	(15.65)	(12.46)	(16.82)	(13.33)	(13.43)
Wald test	549.14	432.51	482.51	555.68	599.52	412.58	452.35	600.03
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sargan test	41.09	26.84	11.18	40.35	23.05	28.30	10.53	26.094
Prob > chi2	0.0000	0.0015	0.2637	0.0000	0.0174	0.0029	0.4832	0.0165
AB2 test	0.229	-0.059	2.067	0.065	0.989	-0.038	2.249	1.290
Prob > z	0.8192	0.9530	0.0387	0.9479	0.3229	0.9693	0.0245	0.1970

Source: elaborations on Bank of Italy, ISTAT and Guglielmo Tagliacarne Institute data.

Notes: The values highlighted in bolditalics refer to predetermined variables, while the other values refer to strictly exogenous variables. The values in brackets are the values of the z-statistic. *** variable significant at the 1%, ** at the 5%, * at the 10%.

Appendix 1.2: The Arellano and Bond estimator

In 1991, Arellano and Bond (AB henceforth) provided an efficient estimator for dynamic panel models in which the number of time periods, T, is small and the number of individual units, N, is large.

More in details, this estimator is an application of the Generalized Method of Moments (GMM) on first-differenced equations.

Let us take into consideration the following autoregressive model without regressors:

$$y_{it} = \sum_{j=1}^{p} \alpha_j y_{i(t-j)} + u_{it}, \quad |\alpha_j| < 1, \quad t = (p+1), ..., T, \quad i = 1, ..., N \qquad [1]$$

where $u_{it} = \eta_i + v_{it}$, $|\alpha_j| < 1$ is the stationarity condition, p is the number of lags of the dependent variable, $\eta_i \sim \text{IID}(0, \sigma^2_\eta)$ and $v_{it} \sim \text{IID}(0, \sigma^2_v)$

Note that $y_{i(t-j)}$ and η_i are necessarily correlated. The transformation in first differences allows to eliminate the individual effects, but it reduces the number of observations.

The AB estimator exploits all the possible moment conditions and let their number change according to t.

Let us suppose, for example, that the number of lags, p, is equal to 1 and that the only parameter to be estimated, α, is associated with the variable y lagged value of one period.

Model [1] becomes:

$$y_{it} = \alpha y_{i(t-1)} + \eta_i + v_{it}, \quad |\alpha| < 1, \quad t = 2, ..., T, \quad i = 1, ..., N \qquad [2]$$

while the model in first differences becomes:

$$y_{it} - y_{i(t-1)} = \alpha(y_{i(t-1)} - y_{i(t-2)}) + (v_{it} - v_{i(t-1)}))$$

$$\Rightarrow \Delta y_{it} = \alpha \Delta y_{i(t-1)} + \Delta v_{it}, \qquad t = 3, ..., T \quad i = 1, ..., N \qquad [3]$$

For $t = 3$, we have:

$$y_{i3} - y_{i2} = \alpha(y_{i2} - y_{i1}) + (v_{i3} - v_{i2})$$

where y_{i1} is a valid instrument for $(y_{i2} - y_{i1})$ because it is correlated with the latter but not with $(v_{i3} - v_{i2})$ as long as v_{it} is serially uncorrelated.
For t = 4, we have:

$$y_{i4} - y_{i3} = \alpha(y_{i3} - y_{i2}) + (v_{i4} - v_{i3})$$

In this case, both y_{i1} and y_{i2} are valid instruments for $(y_{i3} - y_{i2})$, because they are correlated with the latter difference but they are not correlated, under the assumptions of the model, with $(v_{i4} - v_{i3})$.
Hence, the set of valid instruments, as shown in the following scheme, depends on time:

Equation:	Instrument:
$\Delta y_{i3} = \alpha \Delta y_{i2} + \Delta v_{i3}$	y_{i1}
$\Delta y_{i4} = \alpha \Delta y_{i3} + \Delta v_{i4}$	y_{i1}, y_{i2}
$\vdots$	$\vdots$
$\Delta y_{iT} = \alpha \Delta y_{i(T-1)} + \Delta v_{iT}$	$y_{i1}, y_{i2}\ y_{i3}, ..., y_{i(T-2)}$

The moment conditions exploited by the AB procedure (whose number is time varying) are:

$$E[(v_{i3} - v_{i2})y_{i1}] = 0 \qquad t = 3$$

$$E[(v_{i4} - v_{i3})y_{i1}] = 0 \qquad t = 4$$
$$E[(v_{i4} - v_{i3})y_{i2}] = 0$$

Generally, for T time periods, the model implies the following $\mathrm{m} = \frac{(T-1)(T-2)}{2}$ moment conditions:

$$E\left[(v_{it} - v_{it-1})y_{i(t-j)}\right] = 0 \qquad j = 2, \ldots, (t-1), \quad t = 3, \ldots, T \qquad [4]$$

These moment conditions can be concisely written as:

$$E[Z'_i\, \bar{v}_i] = 0 \qquad [5]$$

that is equivalent to:

$$E\left[Z'_i(\Delta y_{it} - \Delta y_{i(t-1)})\right] = 0 \qquad [6]$$

where Z_i is the matrix of instruments[9]:

$$Z_i = \begin{bmatrix} y_{i1} & 0 & 0 \\ 0 & y_{i1}, y_{i2} & 0 \\ . & . & . \\ 0 & 0 & y_{i1}, \cdots, y_{i,T-2} \end{bmatrix} \qquad [7]$$

and $\bar{v}_i = (\Delta v_{i3}, \cdots, \Delta v_{iT})'$ is a $[(T-2) \times 1]$ vector [8]

Analogously, let us define the vectors:

[9] Z_i is a $[(T-2) \times m]$ block diagonal matrix whose sth block is $(y_{i1}, \cdots, y_{is})$.

$\bar{y}_i = (\Delta y_{i3}, \cdots, \Delta y_{iT})'$ as a $[(T-2) \times 1]$ vector [9]

and $\bar{y}_{i(-1)} = (\Delta y_{i2}, \cdots, \Delta y_{iT-1})'$ as a $[(T-2) \times 1]$ vector [10]

If the errors are independent distributed with constant variance σ^2, we have $E[\bar{v}_i \bar{v}'_i] = \sigma^2 H$, where H is a $(T-2)$ square matrix which has twos in the main diagonal, minus ones in the first subdiagonal and zeros otherwise.

$$H = \begin{bmatrix} 2 & -1 & 0 & \cdots & 0 & 0 & 0 \\ -1 & 2 & -1 & \cdots & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & \cdots & -1 & 2 & -1 \\ 0 & 0 & 0 & \cdots & 0 & -1 & 2 \end{bmatrix} \qquad [11]$$

The AB estimator of α is based on the sample moments $\frac{\sum_{i=1}^{N} Z'_i \bar{v}_i}{N} = \frac{Z' \bar{v}}{N}$

Where $Z = (Z'_1, \cdots, Z'_N)$ is a $N(T-2) \times m$ matrix and $\bar{v} = (\bar{v}'_1, \cdots, \bar{v}'_N)$ is a $N(T-2) \times 1$ vector.

In details, we have:

$$\hat{\alpha} = argmin_{\alpha} (\bar{v}'_i Z_i) A_N (Z'_i \bar{v}_i) = \frac{\sum_i \bar{y}'_{i(-1)} Z_i A_N \sum_i Z'_i \bar{y}_i}{\sum_i \bar{y}'_{i(-1)} Z_i A_N \sum_i Z'_i \bar{y}_{i(-1)}} \qquad [12]$$

By setting $A_N = (\frac{\sum_i Z'_i H Z_i}{N})^{-1}$, the one step AB estimator, $\hat{\alpha}_1$, is obtained. In equation [12], the expression $(\sum_i Z'_i H Z_i)^{-1}$ is a weighting matrix that leads to a consistent estimator of α as long as v_{it} is serially uncorrelated.

If the errors v_{it} are heteroskedastic, it is possible to obtain a more efficient estimator - the so-called two-steps AB estimator, $\hat{\alpha}_2$ - by imposing $A_N = \hat{V}_N^{-1}$ in equation [12], where:

$$\hat{V}_N = \frac{\sum_i Z_i' \hat{\hat{v}}_i \hat{\hat{v}}_i' Z_i}{N} \quad [13]$$

and $\hat{\hat{v}}_i$ are the differenced residuals obtained from the preliminary consistent estimator $\hat{\alpha}_1$.

A consistent estimate of the variance matrix of $\hat{\alpha}$, for an arbitrary A_N, is given by:

$$\widehat{avar}(\hat{\alpha}) = N \frac{\sum_i \bar{y}_{i(-1)}' Z_i A_N \hat{V}_N A_N \sum_i Z_i' \bar{y}_{i(-1)}}{(\sum_i \bar{y}_{i(-1)}' Z_i A_N \sum_i Z_i' \bar{y}_{i(-1)})^2} \quad [14]$$

Note that $\hat{\alpha}_1$ and $\hat{\alpha}_2$ are asymptotically equivalent if the v_{it} are IID(0, σ_v^2). However, AB suggest to employ the one-step estimator in finite-sample inference because, in this framework, according to their simulations, the two-step standard errors could be downward biased in samples of small size.

Let us extend model [2] by including *k* explanatory variables:

$$y_{it} = \alpha y_{i(t-1)} + \beta' x_{it} + \eta_i + v_{it}, \quad |\alpha| < 1, \quad t = 2, ..., T, \quad i = 1, ..., N \quad [15]$$

The parameters in equation [15] can be estimated by using GMM, analogously with the model without explanatory variables above illustrated. In other words, the procedure remains the same as before, but the set of valid instruments will change according to the hypothesis about x_{it}.

More in details, if all the x_{it} are correlated with η_i:

- If x_{it} are strictly exogenous, that is if $E[x_{it} v_{is}] = 0$, for all $t, s = 1, 2, \cdots, T$, then all the x_{it} are valid instruments for the first differenced equation of [15]. In this case, $[x_{i1}', x_{i2}', \cdots, x_{iT}']$ should be added to each diagonal element of Z_i. Therefore, the instruments matrix becomes:

$$Z_i = \begin{bmatrix} [y_{i1}, x'_{i1}, x'_{i2}, \cdots, x'_{iT}] & 0 & 0 & 0 \\ 0 & [y_{i1}, y_{i2}, x'_{i1}, x'_{i2}, \cdots, x'_{iT}] & 0 & 0 \\ \vdots & \cdots & \ddots & \cdots \\ 0 & 0 & 0 & [y_{i1}, \cdots, y_{i(T-2)}, x'_{i1}, x'_{i2}, \cdots, x'_{iT}] \end{bmatrix} \quad [16]$$

- If x_{it} are predetermined, that is if $E[x_{it}v_{is}] = 0$ for $s \geq t$ and $E[x_{it}v_{is}] \neq 0$ for $s < t$, then, for every *s*, only $[x'_{i1}, x'_{i2}, \cdots, x'_{i(s-1)}]$ are valid instruments for the differenced equation at period *s*.
  In this case, the instrument matrix becomes:

$$Z_i = \begin{bmatrix} [y_{i1}, x'_{i1}, x'_{i2}] & 0 & 0 & 0 \\ 0 & [y_{i1}, y_{i2}, x'_{i1}, x'_{i2}, x'_{i3}] & 0 & 0 \\ \vdots & \cdots & \ddots & \cdots \\ 0 & 0 & 0 & [y_{i1}, \cdots, y_{i(T-2)}, x'_{i1}, x'_{i2}, \cdots, x'_{i(T-1)}] \end{bmatrix} \quad [17]$$

Let us suppose instead that there exists a subset x_{1it} of x_{it} uncorrelated with η_i. In this case:

- If x_{it} are strictly exogenous, observation on x_{it} for all *t* become valid instruments in the levels equations. There are only T extra restrictions that can be expressed as:
  $E\left[\frac{\sum_{s=1}^{T} u_{is}x_{1it}}{T}\right] = 0, (t = 1, \cdots, T)$
- If x_{it} are predetermined, according to AB there are other T extra restrictions: $E[u_{i2}x_{1i1}] = 0$ and $E[u_{it}x_{1it}] = 0$, for $(t = 2, \cdots, T)$. The optimal matrix of instruments becomes:

$$Z_i^+ = \begin{bmatrix} Z_i & 0 & 0 & 0 & 0 \\ 0 & [x'_{i1}, x'_{i2}] & 0 & 0 & 0 \\ 0 & 0 & x'_{i3} & 0 & 0 \\ \vdots & \vdots & \cdots & \ddots & \vdots \\ 0 & 0 & 0 & 0 & x'_{iT} \end{bmatrix} \quad [18]$$

where Z_i is given by [17].

The AB estimator is consistent if there is no second-order serial correlation among the residuals of the regression, i.e. $E[v_{it}v_{i(t-2)}] = 0$.

In order to test this hypothesis, AB propose a test based on residuals from the first-differenced equations and that is defined only for $T \geq 5$[10]. The null hypothesis of lack of second-order serial correlation is not rejected if the errors in the model in levels are not serially correlated or if they follow a random walk process. In the latter case, AB pointed out that both OLS and GMM estimates in first-differences are consistent and they suggest a Hausman type test based on the differences between the two estimators.

Furthermore, AB suggest a Sargan test to verify the hypothesis of validity of over-identifying restrictions given by:

$$s = \sum_i \hat{v}_i' Z_i \left(\sum_{i=1}^{N} Z_i' \hat{v}_i \hat{v}_i' Z_i\right)^{-1} \sum_i Z_i' \hat{v}_i \quad \tilde{a}\; \chi^2_{p-k-1} \qquad [19]$$

where $\hat{v}_i = y_{it} - \hat{\alpha}_2 y_{i(t-1)} - \hat{\beta}_2' x_{it}$, $\hat{\alpha}_2$ and $\hat{\beta}_2$ are the two-step estimates of α and β for a given instrument matrix of instrument Z_i, p is the number of columns in Z_i and k is the number of coefficients to be estimated.

[10] See equations (8) and (9), page 282, in Arellano and Bond (1991), *Some Tests of Specifications for Panel Data: Monte Carlo Evidence and an Application to Employment Equations*, in "The Review of Economic Studies Limited", 58.

CHAPTER 2: CREDIT RISK DETERMINANTS AND SPREADS RISK ADJUSTED FOR ITALIAN REGIONS

2.1 Introduction

During the last decade, the debate about the possible consequences of the Basel Accords generated a renewed interest in modeling credit risk's determinants.

Economists generally believed that Basel II would have ensured an increase in the stability of the financial system by identifying a quantitative relationship between banks' capital requirements and riskiness of their assets.

The recent global crisis has determined concerns about the Basel II Accord efficacy. However, the main weaknesses of this accord were due to the limited attention on liquidity risk, on the quality of the instruments that could be included into the regulatory capital and on capital requirements' procyclicality; on the contrary, credit risk management continues to play a central role also in the current revision framework.

Hence, the default risk assessment remains a crucial aspect in credit policies. Particularly, because capital requirements positively depend on borrowers' probability of default (PD), if banks overestimate the credit risk of their assets, they must set aside larger capital provisions and sustain higher costs; on the contrary, an underestimation of the riskiness of banks' assets reduces the overall degree of financial stability in the system.

The relationship between credit risk and capital requirements is on the basis of pricing models currently employed by banks in order to determine the lending rates applicable to their customers.

In light of the above considerations, understanding credit risk's determinants is a crucial issue. Credit risk, expressed in terms of probabilities of default (PD), depends on borrowers' specific characteristics (idiosyncratic components) together with the general economic environment where borrowers operate (systematic factors) that reflects exogenous territorial elements.

In this framework, this chapter aims to examine the idiosyncratic and systematic elements influencing Italian firms' PD. To reach this aim the relationship between credit risk and borrowing conditions is examined at a regional level. The empirical analysis takes into consideration the period 2002-2006 and focuses on 36,303 observations for 10,058 Italian private firms and 639 default cases.

The work is organized into five parts, besides this introduction. Paragraph 2.2 illustrates the main theoretical contributions on the determinants of firms' credit risk. Particularly, it is possible to distinguish four fields of research: models mainly based on firm-specific characteristics; models analyzing the joint effect of idiosyncratic and systematic elements; contributions that are mainly focused on the relationship between default and macroeconomic variables and, finally, contributions mainly based on market information.

Paragraph 2.3 describes the methodology employed, the sample analyzed, the explanatory variables taken into consideration and the main results obtained by estimating the models proposed. The independent variables included in the models are accounting indicators (amount and growth rate of total annual sales, ratio between bank debts and total sales, ratio between equity and total assets, ratio between current assets and current liabilities and ROA index), macroeconomics variables (GDP growth rate and GDP per capita) and indicators of the financial system structure (loans growth rate, incidence of cooperative banks and branches in the banking system and number of branches and banks every 10,000 inhabitants).

Paragraph 2.4 analyzes the effect of credit risk in the determination of lending rates. By following Zazzara and Cortese (2004), this paragraph presents a model to estimate the Spread Risk Adjusted (SRA), that is the metric the represents the share of the final lending rate exclusively based on loans' credit risk.

In paragraph 2.5, the value of the SRA for each observation is estimated while the main results of the analysis are summarized in paragraph 2.6.

2.2 Literature review

In recent years, the debate about the possible consequences of the Basel Accords has renewed the attention on the measurement and pricing of credit risk, tools able to favor the stability of the banking and financial system.

The earliest analysis concerning the identification of credit risk's determinants date back to the sixties of the last century. During this period, Beaver (1966) and Altman (1969) developed the first models to assess private firms' credit risk. These studies applied discriminant analysis and used, primarily, firms' accounting data.

The following developments focused on the identification of the idiosyncratic and systematic components of credit risk and are subdivided into the following categories (table 2.1):

- models mainly based on firm-specific characteristics;
- models analyzing the joint effect of the idiosyncratic and systematic components of credit risk;
- models primarily focused on the relationship between default and macroeconomic variables;
- models that point out the importance of market information to evaluate firms' credit risk.

The first group of studies includes Bernhardsen (2001), Eklund et al. (2001), Bunn and Redwood (2003) and Jiménez and Saurina (2004).

Models based on accounting data take into account some measures of profitability, liquidity and leverage. Nevertheless, there is no consensus about which variables are the most important in the estimation of the PD.

Bernhardsen (2001), Eklund et al. (2001) develop a model in order to predict bankruptcy probability on the basis of a sample of Norwegian firms during the period 1990-1996 (about 400,000 observations). According to firm-specific data

Table 2.1. Literature about credit risk's determinants.

Authors	Year	Methodology	Main explanatory variables	Approach
Bernhardsen Eklund, Larsen and Bernhardsen	2001 2001	Transformed logit model	- (Cash and deposits - Value of short term debt)/Revenue from operations - Outstanding payments of public dues/Total assets - Trade credits/Total assets - (Result before extra ordinary items + Ordinary write offs + Depreciation - Taxes)/Total assets - Book value of equity/Total assets - Current book value of equity is less than the value of equity injected (dummy) - Dividends paid current year - Number of years since incorporation (8 dummies) - $(\text{Ln(total assets)} - 8{,}000)^2$ - Mean value, for the industry, of the ratio Book value of equity/Total assets - Mean value, for the industry, of the ratio Trade credits/Total assets - Variance of the variable (Results before extra ordinary items + Ordinary write offs + Depreciation - Taxes)/Total assets	Models mainly based on firm-specific characteristics
Bunn and Redwood	2003	Probit model	- Profit margin (3 dummies) - Ebit/Interest payments - Debts/Total assets - Liquidity ratio - Profit margin < 0 and Debts/Total assets > 0.35 (dummy) - Ln(number of employees) - The firm is a subsidiary (dummy) - Industry (6 dummies) - Profit margin < 0 and the firm is a subsidiary (dummy) - GDP growth rate	
Jiménez and Saurina	2004	Logit model	- Collateral coverage (3 dummies) - Type of financial institution (3 dummies) - Type of instrument (6 dummies) - Currency (dummy) - Maturity (2 dummies) - Temporal dummies - Size of the loan - Number of borrowers' banking relationships - Industry (10 dummies) - Region (17 dummies) - GDP growth rate	

Table 2.1 (continued) - Literature about credit risk's determinants.

Authors	Year	Methodology	Main explanatory variables	Approach
Benito, Javier Delgado and Martinez Pagés	2004	Probit model	- Industry (15 dummies) - Borrowing ratio (Interest payments/Ordinary profit plus interest payments) - Return on assets - Liquid assets/Total assets - Debts/Total Assets - Trade credits/Total Assets - Omit dividend - Real sales growth - Ln(real sales) - Firm age (dummy) - GDP growth rate - Time dummies	Models analyzing the joint effect of the idiosyncratic and systematic components of credit risk
Carling, Jacobson, Lindé and Roszbach	2007	Duration model	- Duration dummies - Credit type according to the maturity (3 dummies) - Total sales - EBITDA/Total assets - Debts/Total assets - Inventories/Total sales - Bank payment remarks - Legal payment remarks - Output gap - Household expectations - Yield curve	
Bonfim	2009	Probit model and duration model	- Sales growth - ROA - Solvency ratio - Investment rate - Liquidity ratio - Industry (11 dummies) - Size (3 dummies) - Interest rate on loans to firms - Yield cuve slope - Loan growth rate - Stock market price variation - GDP growth rate - Temporal dummies	

Table 2.1 (continued) - Literature about credit risk's determinants.

Authors	Year	Methodology	Main explanatory variables	Approach
Borio, Furfine and Lowe	2001	Descriptive analysis	- Output gap - Indicators of banking system performance (provisions, profitability, equity prices, capital) - Loan to value ratio	Models that are mainly focused on the relationship between default and macroeconomic variables
Pederzoli and Torricelli	2005	Conditional and unconditional PDs and probit models	- Term spread between the ten-year treasury bond and the three-month treasury bill rate	
Jiménez and Saurina	2006	GMM estimations, logit and probit models	- Loan growth rate - Size of the loan - Maturity of the loan (2 dummies) - Collateral coverage (2 dummies) - Region (dummies) - Industry (dummies) - Size of bank - Type of bank (dummies) - Time dummies - GDP growth rate - Borrowers' characteristics (if they were in default the year before or the year after the loan was granted, their indebtedness level) - Characteristics of the borrower-lender relationship (duration and scope) - Level of competition in the loan market	

Table 2.1 (continued) - Literature about credit risk's determinants.

Authors	Year	Methodology	Main explanatory variables	Approach
Shumway	2001	Multiperiod logit model	- Market size - Past stock returns - Idiosyncratic standard deviation of stock returns - Net income/Total assets - Total liabilities/Total assets	Models mainly based on market information
Tudela and Young	2003	Merton approach	- Value and volatility of the company's equity - Book value of the company's equity	
Moody's	2004	Functional form related to generalized additive models (with non-parametric transforms) and Merton approach	- Accounting data, varying according to the country taken into consideration and concerning, generally, profitability, leverage, debt coverage, assets and sales growth rates, liquidity, inventories, cash flow and size - Industry (dummies) - Industry distance to default	
Couderc and Renault	2005	Parametric and semi-parametric factor models	- Return on S&P500 - Volatility of S&P500 - 10 year treasury yield - Slope of term structure - GDP growth rate - Industrial production growth - Personal Income growth - CPI growth - Spread of long term BBB bonds over treasuries - Spread of long term BBB bonds over AAA bonds - Net issues of Treasury securities - Loan growth rate - Investment grade and non investment grade classes upgrade rates - Investment grade and non investment grade classes downgrade rates	

such as firms' age, size, profitability, liquidity and industry's characteristics, the analysis is based on a logit model that estimates the bankruptcy probability.

The non linear nature of the model permits transformations of the explanatory variables to obtain flexible rates of compensation (i.e. varying according to the level of the variables).

According to the model, riskier firms, with a larger bankruptcy probability, are characterized by a lower size (in terms of total assets), profitability, liquidity, an higher gearing and greater value of the ratios between trade creditors and total assets and between outstanding public dues and total assets. The dividend distribution during the last year can be interpreted as a signal of solidity and profitability; therefore the dummy associated with this event negatively influences the bankruptcy probability. Furthermore, under the same conditions, youngest firms are riskier than the oldest ones. Finally, firms' bankruptcy probability is higher in the industries with a greater average degree of leverage and a larger volatility of firms' profitability. Moreover, Bernhardsen distinguishes between the probability of bankruptcy and the probability of insolvency. While bankruptcy probability can be empirically estimated because the bankruptcy event is observable, the prediction of the probability of insolvency is problematic because of the impossibility to observe the state of insolvency. Although these difficulties, according to the author it is possible to compute the bankruptcy probability conditional on the insolvency (estimated to equal 49%).

Runn and Redwood (2003) develop a probit model to identify the determinants of PD on the basis of a sample of English firms (about 100,000 observations), on the period 1991-2001. This sample, however, is not completely representative because it does not include observations about firms with less than 100 employees because, according to the authors, accounting data are generally incomplete for smaller firms.

According to the model, PD is influenced by firm-specific elements (such as profitability, size, industry, liquidity, interest cover and ratio debt/total assets) together with the general conditions of the economy that are represented by the GDP growth rate. Particularly, there is a negative relationship between credit risk and firms' profitability, liquidity, size (in terms of number of employees), interest cover and capitalization. Thanks to the possibility that, in case of difficulties, subsidiary firms can be assisted by the holding company, subsidiary firms are less risky and the size of this effect is larger if the firm makes a loss. Finally, there is a negative relationship between PD and GDP growth rate. This event can be determined by the behavior of banks that, during recession periods, are more risk adverse and tend to close down the largest risks more rapidly.

Jimenéz and Saurina (2004) present a different approach and examine the determinants of the PD analyzing credit risk at a loan level and not at a borrower level. The study is based on over 3 millions loans granted by the Spanish financial system during the period 1988-2000.

The authors, by estimating logit models, come to the conclusion that more collateral imply greater PD because banks tend to require more collaterals for those loans characterized by a greater ex-post credit risk. PD decreases in case of loans in foreign currency, of larger size or with longer maturity. For these loans, in fact, banks pay more attention on their screening process, diminishing ex-post credit risk.

Closer relationships between banks and borrowers (expressed by the number of banks with which each borrowers relates) are characterized by larger PDs: in these conditions, banks are willing to finance riskier loans because they can recover the larger expected loss by applying higher lending rates to their other exclusive or nearly exclusive borrowers. Hence, there are informational rents for banks thanks to the higher quality of information about their borrowers due to the close relationship with the customer.

Finally, the authors point out that, in order to obtain more appropriate estimates of loans' PD, it is necessary to take into consideration also the general conditions of the macroeconomic environment. These conditions can be expressed by the GDP growth rate, variable that negatively influences credit risk.

The group of contributions that jointly analyze the effect of idiosyncratic and systematic elements include Benito et al. (2004), Carling and al. (2007) and Bonfim (2009).

Benito et al. (2004) develop a probit model to estimate the PD on the basis of a sample of about 18,000 non-financial Spanish firms and take into consideration the period 1985-2001. According to the authors, in order to explain exhaustively the determinants of firms' PD, it is necessary to combine accounting data and macroeconomic factors. Furthermore, it is important also to evaluate the firms' credit status since that financial indicators can summarize different information if the default status is a persistent conditions (i.e. if the firm object of analysis stays in this status for more than a year) or a non persistent condition.

Compared with non-defaulting firms, those defaulting are characterized by larger debts, more dividend omissions and lower profitability, liquidity and sales growth. There is a positive relationship between PD and size (in terms of annual sales); younger companies have a higher PD with respect to the older ones. The analysis points out the relevance of the non-linearities in the relationship between PD and financial ratios.

As regards macroeconomic factors, there is a positive relationship between PD and the aggregate cost of debt; on the contrary, GDP growth rate negatively influences firms' credit risk. This condition might be determined by externalities among firms and by a growing risk aversion of banks during recession periods.

Carling et al. (2007) use a different methodology and develop a duration model to explain the determinants of the survival time to default for a sample of about 55,000 Swedish firms (period 1994-2000).

The model includes accounting information, loan-specific characteristics and macroeconomic variables. According to the authors, the general conditions of the macroeconomic environment have a significant explanatory power in the analysis of credit risk. Particularly, the output-gap (defined by the difference between actual and potential GDP), households' expectations and the slope of the yield curve negatively influence credit risk. In terms of idiosyncratic elements, credit risk is positively influenced by the debt ratio and the level of inventories over total sales; on the contrary, there is a negative relationship between credit risk and profitability and credit risk and firms' size (measured by total sales).

The authors point out the importance to take into consideration also the survival time of loans because of the existence of duration dependence. In fact, firms' credit risk increases over the survival of their loans. Particularly, "*the time a borrower has managed to avoid default directly affects the risk of default*" (Carling at al., page 15). This situation is explained by the fact that when firms obtain the required loans, they are characterized by a good degree of solidity because they had managed to pass the banks' screening process. Successively, borrowers' default risk might increase and this tendency is captured by the introduction of time dummies in the model.

In order to explain exhaustively the causes of default rates, also **Bonfim (2009)** focuses on the necessity to jointly analyze accounting data at firm level and macroeconomic elements. Using a sample of 33,000 Portuguese firms (period 1996-2002), Bonfim develops a probit model to estimate firms' PD and duration models examining the time dimension of default risk.

Firms with greater sales growth and investment rates and larger profitability, liquidity and a higher value of the solvency ratio, are also characterized by a lower credit risk in terms of both PD and time to default. Instead, size does not significantly explain the difference in the PD across firms. Among

macroeconomic elements, GDP and loan growth rates are the variables with the largest effect, negative, on credit risk.
According to the author, credit risk is created during expansive periods while the high default rates observed during recession periods represent mainly the materialization of credit risk accumulated during upturns. Macroeconomic dynamics matters and influences firms' credit risk.
The analysis developed by Borio et al. (2001), Pederzoli and Torricelli (2005) and Jiménez and Saurina (2006) belong to the third category of contributions that focus on the relationship between default rates and macroeconomic elements.
Borio et al. (2001) focuses on the procyclical behavior of the financial system that is caused by banks' difficulties in the assessment of credit risk's time dimension. Because of these difficulties, risk tends to be underestimated during expansion periods and, on the contrary, to be overestimated in recession phases. These errors tend to amplify economic fluctuations, causing instability in the system.
According to the authors, banks have to establish their credit policies taking into consideration that risk tends to build up during expansion phases while, during recession periods, most defaults represent the materialization of the risk originated in the past expansion periods. These defaults do not imply, necessarily, an increase in the overall risk in the system.
Hence, banks have to adopt longer time horizons in their risk assessment, while capital requirements should increase during upturns in order to cover losses that will materialize during successive downturns.
Also **Pederzoli and Torricelli (2005)** focus on the procyclicality caused by the general methodology used by banks in order to compute patrimonial requirements. Particularly, they estimate a forward-looking model for time-varying capital requirements. This model could reduce procyclicality and, at the same time, preserve risk-sensitivity of bank provisions proposed by the Basel

Accords. Thanks to the determination of capital requirements depending on the expected macroeconomic conditions, this model allows to overtake the trade-off between risk-sensitivity and procyclicality of provisions. According to this new approach, in fact, banks' provisions increase during upturns (in anticipation of a recession phase) and reduce during downturns (in anticipation of an expansion phase). On the whole, provisions should be more stable during the business cycle.

This model presupposes the estimation of PDs conditional on the expected macroeconomic conditions. For each rating class, particularly, the PD is estimated as the expected value of a default rate whose distribution is a weighted average of an expansion and a recession distribution and the weights are the probability of a future expansion phase and the probability of a future recession phase.

The theoretical model is applied to US data for the period 1971-2002. In this application, the probability of a recession phase is a decreasing function of the term spread between the ten-year Treasury bond and the three-month treasury bill rate.

Jiménez and Saurina (2006) take into consideration the credit risk profile of banks' loan portfolios along the business cycle and, hence, the risk's time dimension.

For the period 1984-2002, the authors verify the hypothesis that during credit expansion (characterized by a loan growth rate larger than the average value), loans' PDs tend to increase. Furthermore, they show that collaterals tend to decrease during expansion periods, when the GDP growth rate is greater than the average level. Therefore, during upturns, banks increase their loan portfolios' risk by reducing the amount and the quality of required collaterals and by financing, with a greater willingness, riskier borrowers. The larger risks built up during upturns will materialize during recession periods, inducing a lower stability in the financial system.

Finally, Shumway (2001), Tudela and Young (2003), Moody's (2004) and Couderc and Renault (2005) belong to the group of works that estimate firms' credit risk on the basis of market information.

According to **Shumway (2001)**, traditional single-period models used to predict firms' credit risk obtain biased and inconsistent estimates with respect to hazard models that are, instead, based on the whole time-series for each firm. In this context, Shumway proposes a hazard model for the estimation of bankruptcy probability that is able to capture the time changes in firms' credit risk. This methodology is empirically applied to a sample of about 3,000 US firms taking into account the period 1962-2002.

Shumway shows that, including in his hazard model the accounting variables used by Altman and Zmijewski, only the ratios EBIT/total assets, market equity/total assets and net income/total assets can significantly explain credit risk. On the contrary, the other variables taken into consideration are not statistically significant bankruptcy predictors.

The author develops a new hazard model that examines the joint effect, on the bankruptcy probability, of accounting data and market variables. Particularly, credit risk is negatively influenced by firm's market size and past stock returns. On the contrary, there is a positive relationship between bankruptcy probability and the idiosyncratic standard deviation of stock returns and between bankruptcy probability and firm's liability. The inclusion in the model of market information considerably improves the accuracy of the estimated bankruptcy probabilities.

Tudela and Young (2003) apply the Merton approach in order to quantify credit risk for a sample of about 7,500 English firms (period 1990-2001).

Differently from the original Merton model, in the Tudela and Young model the event of default can take place at any time and not only at the maturity of the debt.

The predictive capacity, in terms of accuracy-ratio, seems to be larger with respect to the models based exclusively on accounting variables. So, in order to adequately assess credit risk, it is important to take into account also market information at firm level.

The RiskCalc v3.1 model developed by **Moody's (2004)** estimates a credit risk measure, the Expected Default Frequency, on the basis of market information (systematic elements), accounting data (idiosyncratic factors) and industry variables.

This model is developed on the basis of a database concerning accounting data for about 1,500,000 firms and is based on financial ratios varying according to the country where firms operate. Furthermore, the model allows taking into consideration the non-linearities in the relationship between credit risk and financial ratios.

By applying the Merton methodology, the model permits to obtain an assessment of credit risk based on market information also for not publicly traded firms for which market data are not available. This result is achieved by including in the model the distance to default for a sample of publicly trade firms operating in the same industry of the firm object of assessment. According to Moody's, this indicator has a larger predictive capacity with respect to other macroeconomic variables such as interest rates, GNP or unemployment rate.

Finally, **Couderc and Renault (2005)** point out that some of the shortcomings of the most analysis in the literature are the scarce importance given to the business cycle and the use of explanatory variables without lags.

The authors estimate times-to-default of individual firms that belong to different rating classes on the basis of Standard & Poor's ratings database including information concerning ratings of about 10,000 firms during the period 1981-2003. Particularly, the paper examines common drivers of PD by using information about the business cycle and market data. The conclusion is that, in order to identify credit risk's determinants, it is necessary to take into consideration jointly market data and information about business cycle and credit market. Furthermore, in their analysis, not lagged explanatory variables have a limited predictive capacity.

Couderc and Renault reach at the conclusion that economic trends and past shocks appear as the main drivers of the PD.

2.3 The model

2.3.1 The methodology

After analyzing the main factors that, according to the literature, influence private firms' PD in several economic and territorial contexts, in this paragraph I will examine the methodology employed to develop a probit panel model which aim is to identify the main determinants of the default risk for a representative sample of Italian private firms[11].

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[11] The analysis developed in this essay is based on level firm data extracted from the database AIDA (Analisi Informatizzata delle Aziende - Firms analysis computerized), that is provided by Bureau van Dijk Electronic Publisher. I wish particularly to thank Umberto De Marco for the sample provided.

The sample is composed by 10,058 Italian firms (registering 639 default events) for which I examined balance sheets during the period 2002-2006 (on the whole, the number of observations is 36,303).

The stratification method employed to extract the sample permits to examine a representative subset, in terms of industry and territorial distribution, of Italian firms. In more details, for every region, the share of firms extracted from the database AIDA is equal to the percentage actually observed in 2006 according to Unioncamere data. Furthermore, for every region, the number of firms extracted in each economic sector (according to the Classification Ateco 2002), has been established by taking into consideration the actual incidence of each industry in the number of firms in 2006.

For every region and industry, the share of default firms is equal to 6%, which is, on average, the percentage of default firms included in the empirical contributions that I examined in paragraph 2.2.

After determining, the territorial and industry composition of the sample, I used a procedure that permits to consider the main representative firms in the different territorial contexts. First, for every region, inside each industry, I identified the median firm, in terms of total sales, whose balance sheet is included in the AIDA database. Second, the firms extracted have been selected in order to obtain an interval of observations that is centered on the median firm.

The model developed is a probit model applied to panel data with random effects. This type of models is commonly employed in the empirical literature under the hypothesis that errors are normally distributed.

The dependent variable is a binary variable that takes value 1 if the firm "i" is in default at the time "t" and 0 otherwise.

Particularly, a firm is in default if, alternatively, has been declared in failure, has been subject to bankruptcy agreement, is in receivership or if insolvency status has been declared[12].

The model is based on the latent variables methodology that assumes that the variable $Y_{it} \in (0,1)$ is function of a not observable variable – the latent variable – Y_{it}^* that depends, in a linear way, from k independent variables $X_{1it}, X_{2it}, \cdots, X_{kit}$ and an error term u_{it}:

$$Y_{it}^* = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} \cdots + \cdots \beta_k X_{kit} + u_{it} = X_{it}'\beta + u_{it} \qquad [1]$$

$$Y_{it} = \begin{cases} 1 \ if \ Y_{it}^* > 0 \\ 0 \ otherwise \end{cases}$$

where:

X_{it}' = matrix of the k independent variables;

β = vector of the $k + 1$ coefficients.

Given the random structure of the model[13], the error term u_{it} can be subdivided into two components according to the following formula:

[12] This definition is employed by Bureau van Dijk Electronic Publisher.

[13] It is not possible to consider fixed effects in probit panel models.
As $N \to \infty$, for T fixed (that is the case analyzed in this chapter), the number of parameters μ_i increases with N; therefore, μ_i cannot be consistently estimated for T fixed (incidental parameters problem). The inconsistency of $\hat{\mu}_i$ is transmitted also to the maximum likelihood estimator of β.
In the linear case this problem is overcame by eliminating μ_i (by the Within transformation). Instead, in our case, the transformation of the latent model to eliminate the fixed effects does not

$$u_{it} = \mu_i + v_{it} \quad [2]$$

where:

$\mu_i \sim N(0, \sigma_\mu^2)$

$v_{it} \sim N(0, \sigma_v^2)$

$cov(\mu_i, v_{it}) = 0$

μ_i denotes the unobserved period-specific random effect, while v_{it} represents the remainder error term[14].

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make sense because there is not a direct relationship between $y_{it}^* - \bar{y}_i^*$ and $y_{it} - \bar{y}_i$, where $\bar{y}_i^*$ and $\bar{y}_i$ are, respectively, the individual means of y_{it}^* and y_{it}.
To overtake the incidental problem, the usual solution is to maximize the likelihood function conditioned to a sufficient statistic for μ_i.
By denoting the density function of $y_{i1}, \cdots, y_{iT}$ as $f(y_{i1}, \cdots, y_{iT}|\mu_i, \beta)$, a sufficient statistic t_i for μ_i is an observable variable such that:

$$f(y_{i1}, \cdots, y_{iT}|\, t_i, \mu_i, \beta) = f(y_{i1}, \cdots, y_{iT}|\, t_i, \beta)$$

where the second density function does not depend on μ_i. Consequently, to overcome the incidental parameter problem it is possible to maximize the conditional likelihood function $f(y_{i1}, \cdots, y_{iT}|\, t_i, \beta)$.
For the logit specification, Chamberlain (1980) finds that $\bar{y}_i$ is a sufficient statistic for μ_i. Instead, for the probit specification, a sufficient statistic for μ_i does not exist (Baltagi, 2008); therefore, the probit panel model can be estimated only with a random effects specification.

[14] Defining ρ as the proportion of the total variance of the error component $\mu_i + v_{it}$ due to the variance of the individual fixed effects μ_i, through the likelihood ratio test it is possible to verify the null hypothesis of not significance of individual random effects ($\rho = 0$) against the alternative hypothesis of individual heterogeneity ($\rho > 0$).

$H_0: \rho = 0$
$H_1: \rho > 0$

The likelihood ratio statistic is calculated on the basis of the following formula:

$$LR = 2(L_{ur} - L_r) \sim \chi^2(1)$$

where:
L_{ur}= value of the log-likelihood function in the unrestricted model (model with individual random effects);
L_r= value of the log-likelihood function in the restricted model (model under the null hypothesis of not significance of the individual random effects).

Hence, according to the latent variable approach we have:

$$Prob[Y_{it} = 1] = Prob[Y_{it}^* > 0] = Prob[X_{it}'\beta + u_{it} > 0] = Prob[X_{it}'\beta + \mu_i + v_{it} > 0] = Prob[v_{it} > -X_{it}'\beta - \mu_i] = F(X_{it}'\beta + \mu_i) \quad [3]$$

where $F(X_{it}'\beta + \mu_i)$ is the cumulative distribution function for u_{it}.

In the empirical analysis, the independent variables are lagged of one period because of the lags with which, generally, they influence the default event and to avoid endogeneity problems.

2.3.2 The variables

This analysis can be included into the second category of models with which the literature intends to explain credit risk's determinants; in fact, this chapter simultaneously examines idiosyncratic factors at firm level and macroeconomic elements.

The PD for a given firm depends on its specific accounting characteristics (idiosyncratic components) together with the general economic environment where it operates (systematic factors). A more dynamic economic context might be characterized from a larger presence of firms with a greater financial solidity (and, hence, with a lower riskiness). At the same time, a more dynamic economic environment might encourage expansive bank credit policies increasing the average risk profile of banks' borrowers.

In light of the above considerations, our model examines the relationship between the PDs of a representative sample of Italian firms, their main accounting indexes and a small group of macroeconomic variables expressed at a regional level. Following Shumway (2001) and other authors, also market information are significant factors in explaining firms' credit risk. However, because of the limited size of the Italian market and the consequent availability

of market information only for a very restricted number of Italian firms, in this analysis it is not opportune to take into consideration market information.
The independent variables included into the models are subdivided into two categories. The first one consists of idiosyncratic indicators drawn from firms' balance sheets that change among firms and over time. The second class of independent variables comprises macroeconomic indicators changing among regions and over time: for every year of the period analyzed, the value of these variables does not change among firms operating in the same region but vary only among firms operating in different regions.
In order to identify the firm-specific factors influencing the PD, I included, among the independent variables, the main accounting indicators traditionally considered in the literature.
Hence, this analysis examines the effect on the PD of firms' size, solidity, liquidity, profitability, sales growth rate and the ratio between bank debts and total sales. With particular reference to the last two indicators, the sales growth rate is a measure of firms' short term performance and should negatively influence the risk of default. The relationship between PD and the ratio bank debts/total sales is more controversial. Larger bank debts should induce greater interest expenses and larger financial pressures, increasing the risk of default. On the other hand, we could empirically observe a negative relationship between this ratio and credit risk. The reason depends on banks' behavior because they tend to grant larger loans to firms characterized by a greater solidity degree and, hence, a lower PD.
As regards the other accounting indicators included in the analysis, the ratio between equity and total assets has been considered by the literature as a proxy of firms' solidity. The risk of default should decrease if this ratio increases because a lower incidence of debts in total assets should induce less financial pressures. Moreover, the presence of a considerable amount of equity is a

crucial aspect because, in this case, firms are more likely able to get external finances and reduce the probability of default.

Also liquidity should negatively influence, in the short run, firms' credit risk. Particularly, the liquidity index taken into consideration in the empirical analysis is the ratio between current assets and current liabilities. An increase of this ratio should allow to firms to punctually manage their short-term obligations, reducing their PD.

Profitability should negatively affect the risk of default; in fact, a larger profitability should be associated with greater cash flows allowing firms to manage their obligations with more facility. Additionally, greater earnings should increase the firms' ability to obtain external finance. Finally, a greater profitability should allow to firms to set aside larger financial reserves increasing, by this way, their solidness.

More in details, the profitability measures taken into consideration are the Return on Assets (ROA) and the Return on Equity (ROE). I consider ROA a better indicator to analyze the firm's ability to generate wealthy because it is a metric of the normal profitability level. This index expresses the profitability of the operating activity and does not include the results of financial and extra ordinary activities. In order to avoid multicollinearity problems caused by the significant correlation between ROE and ROA (0.43 in the sample), only the ROA index is included in the econometric analysis.

I employed two indicators for firms' size: total sales and total assets. The current literature agrees with the presence of a significant and negative relationship between size and PD. However, there are several contributions stressing that larger firms have a greater risk of default (Benito et al., 2004) or retaining that the relationship between firms' size and PD is not statistically significant (Bonfim, 2009).

For the second category of regressors, reflecting macroeconomic dynamics on default risk, I included in the econometric analysis a set of variables (at a regional level) able to summarize the general conditions of the economic and financial system: the real GDP growth rate, the real GDP per capita, the unemployment rate, the loan growth rate, the ratio between cooperative banks (branches) and total banks (branches) and the number of banks and branches per 10,000 inhabitants.

While the real macroeconomic variables (GDP and loan growth rates) have been traditionally taken into consideration to explain credit risk according to macroeconomic dynamics, information about the structural conditions of the banking system is generally ignored. By considering these variables, it is possible to verify if there exists a statistical relationship between the banking structure and the default event. Particularly, the analysis of the statistical significance of the number of banks and branches per 10,000 inhabitants and the incidence of cooperative banks and branches in the system allows to empirically evaluate if the spatial and social proximity between banks and firms influences firms' risk of default.

2.3.3 The empirical analysis

The empirical analysis takes into consideration the period 2002-2006 focusing on 36,303 observations for 10,058 Italian firms registering 639 default events. Firm-specific accounting data are drawn from the database AIDA (*Analisi Informatizzata delle Aziende* - Firms analysis computerized) produced by Bureau van Dijk Electronic Publishing. Data on GDP growth rate, GDP per capita, unemployment rate and population have been elaborated by the Italian National Statistical Office (ISTAT), while data concerning the banking system structure have been supplied by Bank of Italy.

Table A2.1 shows the mean and median values of the main accounting indexes for the firms in default and for the remaining firms.

On average, default firms seem to differ from other firms. Particularly, in terms of median values, default firms are slightly smaller with respect to non-default firms both in terms of total sales and total assets. Moreover, coherently with the literature, default firms present a lower degree of profitability (both in terms of ROA and ROE) and liquidity, larger debts and a lower ratio between equity and total assets.

Also the median sales growth rate is considerably different among these subsamples. Particularly, this indicator takes a positive value (+10.0%) for non default firms and is equal to zero for the other firms.

The differences between default firms and non-default firms in terms of ratio between bank debts and total sales are less significant: for the first subsample the mean of this indicator is equal to 8.57 while it is equal to 9.26 for non default firms.

In order to avoid possible biases caused by outlier values, in the econometric estimation, for every accounting index, I set those observations above the 99th percentile and below the 1st percentile at the value, respectively, of the 99th and 1st percentile.

On the basis of the methodology illustrated in paragraph 2.3.1, I elaborated a set of probit models with random effects in order to estimate the probability of firm being in default during the following year, based on accounting and macroeconomic data for the current year. Table A2.4 shows the results for the estimated models.

Initially, the estimated models are based exclusively on firm-specific accounting data (model 1 – model 4); then, in order to analyze the determinants of firms' PD taking simultaneously into consideration data at firm level and macroeconomic dynamics, also macroeconomic indicators have been included among the explanatory variables (model 5 – model 13).

The models do not include regional and industrial dummies because, for every region and industry, the share of default firms is the same, i.e. it is equal to 6% (for further information see note 11).

To avoid multicollinearity problems caused by the correlation between the ratio equity/total assets and the liquidity index (as shown in table A2.2, the correlation coefficient between these two indicators amounts to 0.45), the effect of these variables on default risk is evaluated through different regression models.

The explanatory variables in model 1 and model 2 are the amount and the growth rate of total sales, the ratio between bank debts and total sales and the ROA index. The first model includes, among regressors, also the ratio equity/total assets; the liquidity ratio is considered in model 2. Coherently with the literature, the degree of profitability and liquidity and the amount of equity affect negatively and significantly the risk of default; on the contrary, there is no significant relationship between size (expressed in terms of total sales) and PD. Moreover, according to these models, the sales growth rate does not influence credit risk, while there is a negative relationship between the ratio bank debts/total sales and PD at 10% level of significance.

As indicated above, the literature agrees on the presence of a significant and negative statistical relationship between firms' size and PD. However, other works consider a positive relationship between these two variables (Benito et al., 2004) or a not significant relationship (Bonfim, 2009). In order to assess more accurately the dimensional effect, I take into consideration an alternative indicator of the firms' size: the amount of total assets.

Model 3 and model 4 examine the relationship between PD, total assets, sales growth rate, ratio between bank debts and total sales, ROA, ratio equity/total assets (model 3) and liquidity index (model 4). These models confirm the existence of a negative and significant relationship between PD, profitability, equity and liquidity. Furthermore, according to model 3, there is a positive statistical relationship between firms' PD and size (measured by total assets) at 10% level of significance.

Departing from model 3 (that is the best model, among these four specifications, in terms of pseudo-R^2), I tried several other specifications including also macroeconomic variables. Because of the significant correlation between GDP per capita and unemployment rate, GDP per capita and number of branches per 10.000 inhabitants and between the latter variable and the unemployment rate (see table A2.3), the effect of these pairs of variables on firms' PD is estimated through separated regressions.

All these specifications confirm the results achieved by the first four models. In other words, at idiosyncratic level, an increase in profitability or equity leads to a decline in PD.

On the contrary, the relationship between size (expressed in terms of total assets) and default risk is significantly positive, in agreement with Benito's conclusions. This finding denies the traditional opinion that smaller firms, because of their "structural weakness", are riskier than larger firms. This result can be explained by two possible factors. A self selection approach could indicate how the sample's coverage of small firms might be biased towards "good" companies (in order to explain the positive relationship between credit risk and size, Benito follows this reason). The second cause, of economic nature, might be the existence, for larger firms, of possible diseconomies of scale that reduce their creditworthiness.

In order to identify the possible macroeconomic determinants of default risk, together with the accounting indicators included in model 3, model 5 and 6 comprise also GDP and loan growth rates, GDP per capita (model 5) and unemployment rate (model 6). According to these models, GDP and loan growth rates influence significantly and negatively firms' PD, while the structural characteristics of regional economies (expressed in terms of GDP per capita or unemployment rate) do not affect significantly the risk of default.

Models 7 and 8 add to the variables included in model 5, respectively, the share of cooperative banks in the system and the number of banks per 10,000 inhabitants. These two models confirm the results achieved by model 5 and show that there does not exist a significant relationship between the two variables concerning the structure of the banking system and firms' PD. In other words, in the Italian context a higher spatial and social closeness between banks and firms does not lead to better performances of the entrepreneurial system measured via default events.

These conclusions remain valid even if the share of cooperative banks is replaced using the share of cooperative branches (model 9).

Models 10, 11 and 12 include the same regressors of models 7, 8 and 9 with the exception of GDP per capita that is replaced by the unemployment rate. These models generally confirm the results illustrated above; however, according to model 11 there exists a positive relationship (at 10% level of significance) between number of banks per 10,000 inhabitants and risk of default.

Finally, model 13 includes among the macroeconomic regressors, GDP and loans growth rates and the number of branches per 10,000 inhabitants. The positive relationship between the latter variable and PD is coherent with model 11.

The lack of a negative impact, on firms' PD, of the social closeness between banks and firms, expressed in terms of incidence, in the banking system, of cooperative banks and branches, might be due to the low amounts of loans granted by these financial institutions.

In other words, although at a microeconomic level, cooperative banks can play an important role in supporting firms that experience financial difficulties (in fact, they traditionally tend to be more sensitive to local firms' problems), at an aggregate level the limited share of loans granted by these banks might lead to the lack of a negative statistical relationship between their number and the risk of default.

Totally, these estimates indicate that, in the Italian system, the crucial determinants of credit risk are idiosyncratic factors at firm level: particularly, firms' financial structure, liquidity and profitability. Macroeconomics elements at a regional level can be useful in explaining the differences in the riskiness of firms operating in different regions but their inclusion does not improve considerably the models' goodness of fit in terms of pseudo-R^2 (see table A2.4). Banks should hence carefully determine lending rates via a correct and deep analysis of borrowers' structural characteristics.

2.4 The impact of credit risk in bank interest rates and the calculation of the Spread Risk Adjusted

The Basel Accords determine quantitatively the relationship between PD and regulatory capital provisions that banks have to set aside in order to face the credit risk of their loan portfolios. This relationship is on the basis of the pricing models currently employed by banks in order to determine the borrowing conditions to apply to their customers.

Banks have to calculate lending rates that are able to remunerate, together with the funding cost and operating costs, also a set of risks that are linked both to borrowers' riskiness and to the overall banking activity.

Particularly, the main risks of credit intermediation can be subdivided into the following classes:

- operational risk;
- credit risk;
- liquidity risk;
- market risk.

Operational risk is the typical risk of whatever firm and it is related to the variability of expected profit. It is defined by the Basel II Accord (§644) as "*the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. This definition includes legal risk, but excludes strategic and reputational risk*". For smaller banks, for example, a classical operational risk is the possibility to suffer diseconomies of scale linked to the small size.

As regards the second category, credit risk is the possibility that borrowers are not able or willing to accomplish, at the maturity, to their obligations and, hence, do not pay the granted debt (principal and/or interests).

This type of risk was crucial in Basel II and continues to play a central role also in the new proposal to strengthen the resilience of the banking sector (Basel III). In this context, this paragraph focuses on credit risk and aims to examine the relationship between firms' PD and lending rate. Particularly, the share of the final bank interest rate that remunerates exclusively the loan's credit risk is the Spread Risk Adjusted (SRA). This indicator is function of the borrower's PD, the Loss Given Default (LGD), the Exposure at Default (EAD) at the loan's Maturity (M). These values are internally estimated by banks if they adopt the Advanced Internal Rating Based Approach. For those banks adopting the Foundation Internal Rating Based Approach, the only indicator estimated through internal models is the PD; the other parameters assume, instead, values defined by the Basel II Accord.

The current debate focuses with a particular emphasis on the third category of risk. Generally, liquidity risk is linked to the probability that financial entries and disbursements are not temporally correlated compromising, by this way, a firm's profitability or reputation. For banks a careful management of liquidity risk represents a very crucial element because a substantial share of their assets (represented by loans) is not negotiable into secondary markets and a considerable share of their liabilities is represented by short-term debts.

This situation actually occurred, at a global level, during the last two years when the economic crisis and the uncertainty about the correct functioning of the financial system locked the interbank market.

After that the financial crisis had showed the considerable intensity of liquidity risk and its effects on the overall financial system's stability, supervisors have significantly increased their commitment to face this kind of risk.

Particularly, the Basel Committee is introducing a global minimum liquidity standard for internationally active banks that includes a 30-days liquidity coverage ratio requirement underpinned by a longer-term structural liquidity ratio.

Finally, market risk is defined by the Basel II Accord (§683) as "*the risk of losses in on and off-balance-sheet positions arising from movements in market prices*".

In order to determine the final pricing applied to loans, banks have to add to the funding cost a spread to cover operating costs, the SRA and, finally, have to downgrade or upgrade the pricing on the basis of the specific borrower's assignment (also of business type). Although the SRA is a crucial metric to calculate lending rates (it allows to adjust the pricing to the credit risk) it is not binding because the determination of the final pricing remains a business choice. In fact, in the determination of the final lending rate, it is possible to "depart from" the SRA by recuperating profitability margins through an increase of "not lending" earnings and, hence, through those earnings' components that are not linked to credit risk. A parallel way to recuperate profitability margins is the request of further collaterals (banks can reduce the expected loss and capital provisions via loss given default), but at the extreme this procedure denies the logic of a correct pricing determination of risk.

This section, following Zazzara and Cortese (2004), presents a model to calculate the SRA and demonstrates a negative relationship, under the same SRA, between PD and LGD. Furthermore, I simulate the calculation of capital requirements established by Basel II and show that, under the same conditions, capital requirements are larger for loans granted to greater firms.

The underlying logic of the SRA determination process is of statistical-actuarial nature, based on the link between borrower's risk (measured by PD), loans' collaterals (expressed in terms of LGD) and credit risk's remuneration. Particularly, the SRA can be considered as the theoretical price for an insurance against the borrower's default risk, that is the probability of default.
The SRA is computed by adding the expected loss remuneration and the unexpected loss remuneration:

$$SRA = \text{expected loss remuneration} + \text{unexpected loss remuneration} \qquad [4]$$

The expected loss (EL) is calculated by multiplying borrower's PD, LGD and EAD and, because it is expected, it has to be covered by an account-specific provision.

$$Expected\ loss\ (EL) = PD \times LGD \times EAD \qquad [5]$$

The unexpected loss (UL) represents an uncertain event, covered by the bank's equity and can be reduced through adequate diversification policies. Particularly, the UL is the difference between the possible maximum loss for a given time horizon and confidence level (Value at Risk) and the EL. The UL can be considered as a systematic component of risk, estimable through a portfolio model. Nevertheless, according to several authors[15], the portfolio models employed by the main investment banks and by the main international consulting companies (the Creditmetrics model of JP Morgan, the CreditRisk+ model of Credit Suisse First Boston, the Credit Portfolio View model of McKinsey and the Portfolio Manager model of KMV) are not sufficiently adequate to estimate the UL linked to illiquid assets (such as credit loans)

[15] See Zazzara and Cortese (2004).

because these models are mainly based on market data. Taking into consideration these limits, the Basel Committee developed the functions to calculate the level of capital requirements that banks have to set aside in face of a given exposure and that can be considered as an estimate of the UL. In this work, I employ the general functions indicated by the Basel Committee. According to these formulas, the UL is function of PD, LGD, Maturity and total annual sales.

$$K = Unexpected\ Loss = f[PD(+), LGD(+), M(+), Total\ annual\ sales(-)] = RWAs \times 0.08 \quad [6]$$

where RWAs indicates banks' risk weighted assets.

The formulas to compute capital requirements are distinguished according to borrower's total sales level. Particularly, firms are subdivided into three segments: Corporate (if the firm's total sales are greater than 50 millions of euros), Small Medium Enterprise (if the firm's total sales are not greater than 50 millions of euros and the firm does not belong to the Retail class) and Retail (firms whose loans are managed as detail credits and for which the total exposure of the banking group is less than 1 million of euros). Under the same conditions, on the basis of these functions, capital requirements are larger for Corporate segment and decrease for SME and Retail exposures. This relationship derives from the hypothesis that, among the different segments, the average correlation between loans is lower for smaller firms because these firms are less sensitive to the business cycle. Hence, the assumption is that the systematic component of risk, not diversifiable, decreases if also borrowers' size reduces. Consequently, under the same conditions, banks must set aside larger provisions for loans granted to Corporate firms because of the greater riskiness linked to the larger correlation among loans into this segment.

This assumption is incorporated into the functions for the calculation of capital requirements by supposing an inverse relationship between correlation and PD (hypothesizing that smaller firms, because of their structural weakness, have a larger PD with respect to larger firms).
In the following box, the functions for the computation of capital requirements developed by the Basel Committee are shown in detail.
It is worth to note that the Basel Committee's proposals to strengthen the global capital regulation do not change the methodology to calculate RWAs; moreover, the ratio between regulatory capital and RWAs remains equal to 8%[16]. What Basel III will change are the criteria – more rigid - that capital instruments have meet to be included into the regulatory capital.

Box 2.1. Formulas for the computation of banks' capital requirements.

CORPORATE SEGMENT

$$K = \left[LGD \times N\left[(1-R)^{-0.5} \times G(PD) + \left(\frac{R}{1-R}\right)^{0.5} \times G(0.999)\right] - PD \times LGD\right] \times (1-1.5 \times b)^{-1} \times (1+(M-2.5) \times b)$$

$$R = 0.12 \times \frac{\big(1-EXP(-50 \times PD)\big)}{\big(1-EXP(-50)\big)} + 0.24 \times \left[1 - \frac{\big(1-EXP(-50 \times PD)\big)}{\big(1-EXP(-50)\big)}\right]$$

$$b = \big(0.11852 - 0.05478 \times LN(PD)\big)^2$$

$$RWAs = K \times 12.5 \times EAD$$

[16] The only exception is the calculation of capital requirements for exposures to financial intermediaries that are regulated banks, broker/dealers and insurance companies with assets of at least $25 billion, and for exposures to other (unregulated) financial intermediaries, including highly leveraged entities that generate the majority of their revenues from financial activities, such as hedge funds and financial guarantors. For this kind of exposures, the Basel Committee is proposing to apply a multiplicative factor of 1.25 to the formula used to compute the correlation.

SME SEGMENT

$$K = \left[LGD \times N\left[(1-R)^{-0.5} \times G(PD) + \left(\frac{R}{1-R}\right)^{0.5} \times G(0.999)\right] - PD \times LGD\right] \times (1 - 1.5 \times b)^{-1} \times (1 + (M - 2.5) \times b)$$

$$R = 0.12 \times \frac{\left(1 - EXP(-50 \times PD)\right)}{\left(1 - EXP(-50)\right)} + 0.24 \times \left[1 - \frac{\left(1 - EXP(-50 \times PD)\right)}{\left(1 - EXP(-50)\right)}\right] - 0.04 \times \left(1 - \frac{(S-5)}{45}\right)$$

$$b = \left(0.11852 - 0.05478 \times LN(PD)\right)^2$$

$$RWAs = K \times 12.5 \times EAD$$

RETAIL SEGMENT[17]

$$K = LGD \times N\left[(1-R)^{-0.5} \times G(PD) + \left(\frac{R}{1-R}\right)^{0.5} \times G(0.999)\right] - PD \times LGD$$

$$R = 0.03 \times \frac{\left(1 - EXP(-35 \times PD)\right)}{\left(1 - EXP(-35)\right)} + 0.16 \times \left[1 - \left(1 - EXP(-35 \times PD)\right)/\left(1 - EXP(-35)\right)\right]$$

$$b = \left(0.11852 - 0.05478 \times LN(PD)\right)^2$$

$$RWAs = K \times 12.5 \times EAD$$

where:
K = capital requirement;
R = average correlation among loans into the segment taken into consideration;
b = maturity adjustment;

[17] The formulas shown for the calculation of capital requirements and correlation concerning the exposures to the Retail segment refer to loans that are not secured by residential mortgages and that do not represent qualifying revolving retail exposures. For these classes of loans, the Basel II Accord (§§328-329) indicates specific formulas in order to determine capital requirements, whereas correlations take predefined values.

S = total annual sales (total annual sales smaller than 5 millions of euros are considered equivalent to 5 millions of euros in order to calculate capital requirements);
N and G denote, respectively, the cumulative distribution function and the inverse cumulative distribution function for a standard normal random variable;
$RWAs$ = risk weighted assets.

Source: Basel II Accord (§§271-274; 324-330).

Following Zazzara and Cortese (2004), taking into consideration an horizon time of 1 year, in order to compute the cost of EL concerning a given loan, it is possible to adopt the risk-neutrality approach by assuming that a bank is indifferent between to invest in a risk-free security (with a yield equal to rf_1) or to grant, at a rate equal to i_1, a guaranteed loan (with a Loss Given Default equal to LGD_1) to a borrower with a probability of default equal to PD_1. According to this approach, we obtain the following formula:

$$(1 + rf_1) = (1 + i_1) \times (1 - PD_1) + (1 - LGD_1) \times PD_1 \qquad [7]$$

where i_1 indicates the remuneration of the EL linked to a given exposure.
Generalizing for n years, formula [7] becomes:

$$(1 + rf_n)^n = (1 + i_n)^n \times (1 - PD_n) + (1 - LGD_n) \times PD_n \qquad [8]$$

and by solving for i_n we obtain:

$$i_n = ELR = \left[\frac{((1+rf_n)^n - (1-LGD_n) \times PD_n)}{(1-PD_n)}\right]^{1/n} - 1 \qquad [9]$$

where:
rf_n = n years-risk-free rate;
$i_n(ELR)$ = n years rate adjusted for risk. This rate expresses the remuneration of the expected loss;

PD_n = n years probability of default;
LGD_n = n years loss given default.

In order to obtain the spread risk-adjusted that remunerates the expected loss (*ELS*), we have to subtract the risk-free rate from equation [9]:

$$ELS = ELR - rf_n = \left[\frac{((1+rf_n)^n - (1-LGD_n)\times PD_n)}{(1-PD_n)}\right]^{1/n} - rf_n - 1 \qquad [10]$$

By taking into consideration a general horizon time of n years, the remuneration of the UL (that is the second component of the SRA) is calculated on the basis of the following formula:

$$ULR = ECC_n \times (B2_n - EL_n) \qquad [11]$$

where:
ULR = remuneration of the UL;
ECC_n = cost of the economic capital, that is the weighted average of the costs sustained to supply the capital that banks have to set aside in face of the exposure;
$B2_n$ = capital requirement of Basel II;
EL_n = expected loss.

By assuming that the economic capital is composed by risk capital and subordinated liabilities with percentages, respectively, equal to α and β (with $\alpha + \beta = 1$) and that these components are remunerated at rates equal, respectively, to the expected ROE and i_{sub}, the remuneration of the UL can be expressed through the following formula:

$$ULR = (B2_n - EL_n) \times \left(\alpha \times ROE_{expected} + \beta \times i_{sub}\right) \quad [12]$$

The UL spread remuneration (ULS) is then computed by subtracting the risk-free rate from formula [12]:

$$ULS = ULR - rf_n = (B2_n - EL_n) \times \left(\alpha \times (ROE_{expected} - rf_n) + \beta \times (i_{sub} - rf_n)\right) \quad [13]$$

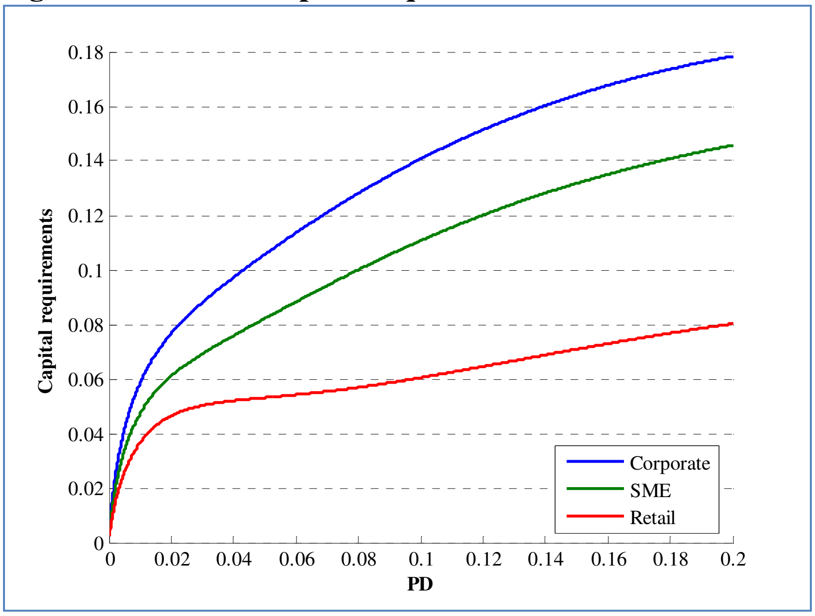
Finally, adding the EL spread to the UL spread, we obtain the total value of the SRA:

$$SRA = \left[\frac{((1+rf_n)^n - (1-LGD_n) \times PD_n)}{(1-PD_n)}\right]^{1/n} - rf_n - 1 + (B2_n - EL_n) \times \left(\alpha \times (ROE_{expected} - rf_n) + \beta \times (i_{sub} - rf_n)\right) \quad [14]$$

According to these results, the lending rate applied to a given exposure is positively influenced by borrower's riskiness (expressed in terms of the borrower's PD) and loan's riskiness (measured by LGD that is influenced by the amount and solidity of collaterals).

Figure 2.1 shows capital requirements distinguished according to the borrower's class. This graph has been elaborated according to the functions defined by the Basel Committee and taking into consideration benchmarking values for LGD, Maturity and EAD equal, respectively, to 45%, 5 years and 100%. Furthermore, for the SME segment, total annual sales are set to 10 millions of euros.

Figure 2.1. Basel II capital requirements.



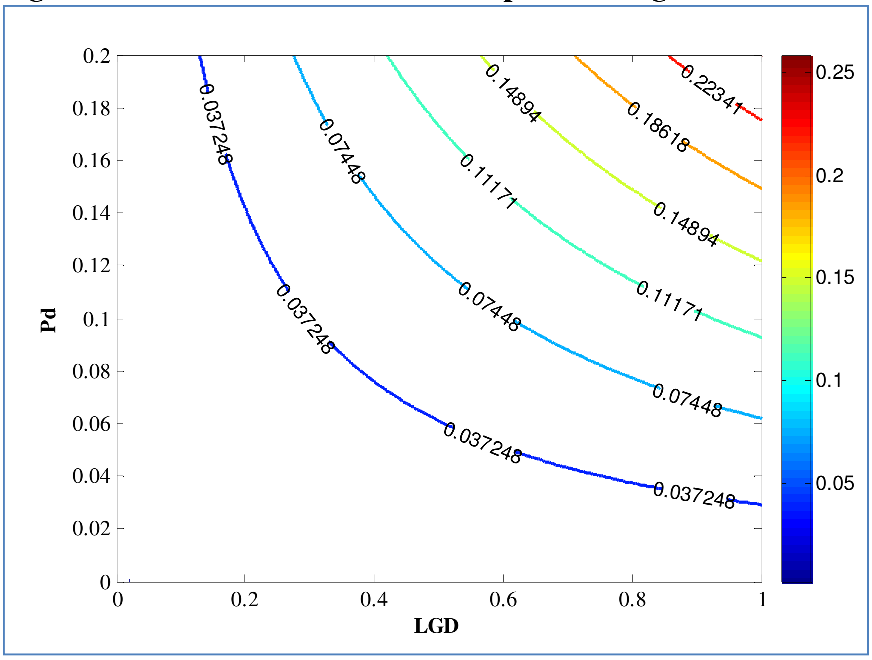
Source: personal elaborations.

These simulations underline that, under the same PD and LGD, loans granted to smaller firms (in terms of total annual sales) determine lower capital requirements. Consequently, under the same conditions, banks should charge lower lending rates to loans granted to smaller firms. Nevertheless, generally, the structural weakness of small and medium firms and their limited ability to provide collaterals Basel II compliant (that are reflected in larger values for the PD and the LGD) may cause the application of larger SRAs with respect to those charged to Corporate firms.

Into the same class of SRA, there is an inverse relationship between PD and LGD. With particular reference to SME segment, figure 2.2 shows the possible combinations PD/LGD that allow falling within the same SRA interval. This graph has been elaborated by assuming that the bank's economic capital is composed by basic equity (Tier 1) and by supplementary capital (Tier 2) with percentages equal, respectively, to 75% and 25% and that these shares are remunerated, respectively, at the expected ROE and at the rate upon subordinated liabilities. Furthermore, the amount of total annual sales taken into consideration is set to 10 millions of euros.

According to the inverse relationship between PD and LGD, if PD increases, firms have to provide further collaterals to reduce LGD in order to fall within the same SRA interval. Moreover, curves farther from the origin are associated with larger SRAs because, under the same PD, an increase of LGD leads to an increase of total credit risk and, therefore, banks should be willing to grant loans only charging worse borrowing conditions. We can consider these curves as "indifferent" combinations between PD and LGD given a fixed level of SRA.

Figure 2.2. PD/LGD/SRA relationship - SME segment.



Source: personal elaborations.

2.5 Simulating SRAs for Italian regions

In this section, the pricing model illustrated in paragraph 2.4 is employed to simulate the SRAs applicable to a sample of Italian firms subdivided into 20 regional subsamples.

These simulations represent the borrowing conditions that banks should apply to their customers, at a regional level, on the basis of objective elements such as the borrowers' PD and loans' LGD.

First, for each firm into the sample, the PD has been estimated taking into account, simultaneously, idiosyncratic factors at firm level and systematic (macroeconomic) elements at regional level.

Among the models that include both idiosyncratic and systematic regressors, I had chosen to employ model 11 given the higher pseudo-R^2 and the greater number of significant independent variables (see Table A2.4).

The mean and median values of the PDs of the non-defaulting firms in the sample are reported in table A2.5.

Southern firms are characterized by a credit risk similar to firms operating in Central Italy, while the territorial area with the greatest average aggregate PD is North-West Italy. These results are contrasting with the common opinion that Southern firms are riskier than Northern and Central firms because of their structural weakness. Presumably, they could be caused by the slenderness of the sample (comprising 10,058 firms) with respect to the entire population (in 2006 Italian firms amounted to 6,125,514) but they remain very significant.

The estimated PDs represent the first input in order to determine the pricing.

The procedure that I use to compute SRA for each observation allows getting results perfectly comparable inside the sample; in other words, the calculated SRAs reflect, exclusively, the differences among firms in terms of PD and, for the SME segment, total annual sales. Therefore, for two firms characterized by the same values of total annual sales and PD, the methodology employed leads to the same value for the SRA, nevertheless the region where the two firms operate.

In order to calculate banks' capital requirements, I applied the functions defined by Basel II (see Box 2.1). These formulas remain valid also according to the current Basel Committee's proposals to determine banks' regulatory capital. Particularly, for 35,658 observations (that do not include default events), I employ the formula defined for the SME segment, while for the remaining 6 observations (regarding firms with total annual sales larger than 50 millions of euros), I use the formula concerning the Corporate segment. Following a general practice in the literature, I hypothesize that banks' economic capital is composed by risk capital (Tier 1) and subordinated liabilities (Tier 2) with percentages respectively equal to 75% and 25%. According to the Basel Committee's new proposal, from 2015 these values will actually become compulsory.

For each firm, the SRA is computed by assuming:

- a PD estimated through model 11;
- with reference to the SME segment, as established by the Basel II Accord, an amount of total annual sales equal to the actual value if sales are larger than 5 millions of euros or, alternatively, equal to 5 millions of euros;
- an LGD equal to 45% for each exposure. This value represents the percentage that, according to the Basel II Accord (paragraph 287), under the IRB Foundation, has to be applied to senior claims on corporate, sovereigns and banks not secured by recognized collaterals;
- a value of maturity equal to 1 year;
- a risk-free rate equal to EURIRS rate 1 year;
- a subordinated claims interest rate (that is the rate that remunerates Tier 2 capital) equal to EURIRS rate 10 years plus a spread of 0,20%;
- an expected ROE (that is the rate that remunerates Tier 1 capital) equal to the subordinate claims interest rate multiplied by 1.5 (I had also

considered a multiplying factor equal to 2, but the results differ, on average, only of about 0.06 percentage points).

After calculating the SRA value for each observation, I estimated 20 regional SRAs by computing, for every region, the arithmetic mean of the SRAs calculated for each firm operating in the region taken into consideration. The results are shown in table A2.5 (not weighted SRA).

The differences, among regions, in terms of SRA, reflect the different aggregate riskiness expressed by the regional average of the PDs.

For Southern regions, the average value of SRA is similar to the one observed in Central Italy, while the geographical area characterized by the highest average SRA is North-West Italy.

By calculating 20 regional SRAs through the arithmetic mean of the SRAs applicable to the firms operating in each region, it is not possible to take into consideration that firms are not equally important in terms of the implications of their potential default. So, I calculated also two synthetic indicators of regional SRA that reflect the amount of total debts and the amount of bank debts for each firm.

The first indicator, SRA_{1r}, is defined, for the region *r*, as the weighted average of the SRAs applicable to the F_r firms operating in the region *r*, where the weights are the amounts of total debts of each firm.

$$SRA_{1r} = \sum_{fr=1}^{Fr} \left(SRA_{fr} \times Total\ debts_{fr} \right) / Total\ debts_r \qquad [15]$$

$$r = 1 \cdots 20$$

where:

F_r =	number of observations in region *r*;
f_r =	observation *f* in region *r*, with $f_r = 1 \cdots Fr$;
SRA_{fr} =	SRA applicable to observation *f* in region *r*;

$Total\ debts_{fr}$ = total debts of observation *f* in region *r*;
$Total\ debts_{r}$ = total debts of firms operating in region *r*.

Analogously, for each region, the second indicator, SRA_{2r}, is the weighted average of the SRAs applicable to every firm in the region, where the weights are the amount of bank debts of each firm.

$$SRA_{2r} = \sum_{fr=1}^{Fr} \left(SRA_{fr} \times Bank\ debts_{fr} \right) / Bank\ debts_{r} \qquad [16]$$
$$r = 1 \cdots 20$$

where:

F_r = number of observations in region *r*;
f_r = observation *f* in region *r*, with $f_r = 1 \cdots Fr$;
SRA_{fr} = SRA applicable to observation *f* in region *r*;
$Bank\ debts_{fr}$ = bank debts of observation *f* in region *r*;
$Bank\ debts_{r}$ = total bank debts of firms operating in region *r*.

The results, shown in table A2.5, confirm the conclusion above illustrated: in Southern regions the indicators SRA_{1r} and SRA_{2r} take values similar to those observed in Central regions and lower than those observed in North areas.
These simulations imply that, on the basis of the sample analyzed and under the hypothesis illustrated, banks should not apply larger lending rates to the firms operating in Southern regions.
Nevertheless, in order to calculate the actual SRA applicable to each firm, it is necessary to know the actual value of the LGD that depends on the type of collaterals provided. This information is not available into the dataset used in the analysis.

A first potential proxy of the LGD at a regional level could be the ratio *losses/total debts* in the bankruptcy procedures. Table A2.6 shows that in North-West and North-East Italy the losses occurred in bankruptcies are generally smaller than those observed in the other areas. On the other hand, by substituting the regional values of the ratio *losses/total debts* to the regional LGDs, the resulting SRAs in the Mezzogiorno are less than the ones simulated for Northern regions. This result remains valid nevertheless the arithmetic or the weighted averages of the SRAs applicable to the regional customers are taken into account (table A2.7).

However, it is necessary to note that in the Mezzogiorno the bankruptcy procedures' average length is considerable larger with respect to Northern regions. Particularly, during the period 2002-2006, in North-West Italy, North-East Italy, Southern Italy and in the Islands, the bankruptcies lasted, on average, 2,572, 2,947, 3,072 and 3,486 days.

This element is important because the larger bankruptcies' length reduces the expected recovery rate and, on the contrary, increases the expected LGD. Consequently, to estimate a proxy for LGD, it seems opportune to combine information about bankruptcies' losses and average length. To this end, for each year of the period 2002-2006, I normalized the bankruptcies' length in the interval 0-1 by calculating an index number with base equal to the maximum length observed in Italian regions. Afterwards, I calculated a second proxy of the LGD at a regional level by computing the mean of this index number and the ratio *losses/total debts* for each region (the underlying hypothesis is that for creditors the amounts that they can recover in bankruptcies procedures and the time length of these procedure have the same importance).

By considering this second regional LGD proxy, the resulting SRAs are more homogenous among areas (table A2.8).

As previously discussed, although the SRA is a crucial indicator to compute lending rates, it is not constraining for banks. In order to determine the final pricing, banks have to take into consideration also other elements such as operating and funding costs. Finally, the determination of the final lending rate remains a "business choice" because banks can "depart from" the SRA by recuperating profitability margins through the increase of "not lending" earnings, not linked to the credit risk.

The results obtained in this analysis allow to conclude that the main cause of the larger lending rates observed, empirically, in Italian Southern regions, cannot be identified in the greater credit risk of the borrowers operating in these areas implied by their structural characteristics. Interregional interest rate spreads in Italy seem related to other factors such as business and institutional considerations.

2.6 Conclusions

The identification of credit risk's determinants continues to be an important topic also in the current revision framework of the Basel II Accord. The Basel Committee's new proposals attribute greater relevance to the credit risk management process, promoting the strengthening of banks' ability to assess borrowers' creditworthiness.

In this framework, this work can be included into the second category of contributions with which the literature intends to explain credit risk's determinants by analyzing simultaneously idiosyncratic factors at firm level and macroeconomic elements. Particularly, the empirical analysis, based on the Italian economic system, took into consideration the period 2002-2006 and the sample examined is composed by 36,303 observations for 10,058 Italian firms.

The factors that are potentially able to explain differences in borrowers' riskiness include both accounting and macroeconomic elements together with variables related to the banking system's structure. On the contrary, the analysis did not take into consideration market information because of the limited size of the Italian market and the consequent availability of this type of information only for a very restricted number of firms.

The results suggest that firms' credit risk is negatively influenced by firms' profitability, degree of liquidity and level of equity on total liabilities.

The relationship between size and default risk is positive. This finding is contrasting with the common opinion that smaller firms are characterized by a larger credit risk because of their structural weakness, but at the same time dimension is not a proxy variable for firm's profitability and solvency.

Firms' probability of default is negatively influenced by GDP and loan growth rate, while the structural characteristics of regional economies (expressed in terms of GDP per capita or unemployment rate) do not affect significantly the risk of default. As regards the structure of the banking system, the degree of territorial diffusion of branches and banks seems to positively influence firms' PD, while the incidence of cooperative banks and branches does not affect firms' default risk. Hence, in the analyzed context, the spatial and social closeness between banks and firms does not reduce the number of default events.

The estimated models indicate that systematic variables can be useful in order to explain the regional differences in the risk of default, but their inclusion does not significantly improve models' goodness of fit. Hence, banks should establish their credit policies and lending rates on the basis of borrowers' structural characteristics such as firms' financial structure, liquidity and profitability.

Moreover, this work points out that in order to establish a credit policy that maximizes the value creation, an adequate bank pricing system represents a crucial aspect together with the actual comprehension of credit risk's determinants.

The analyzed sample shows that another important element is represented by the fact that the SRAs applicable to Southern firms should be not greater than those chargeable to North-Western firms because, according to the sample analyzed, the firms operating in Southern Italy and in the Islands are characterized by a lower average probability of default. So, the higher lending rates actually observed in Southern regions do not seem to reflect the different borrowers' credit risk.

These results should be certainly corrected in order to take into consideration possible differences, among regions, such as the ability to provide recognized collaterals or the degree of efficiency of the bureaucratic apparatus.

However, these results indicate that, in Italy, the application of higher lending rates in Southern regions is not caused by the actual structural borrowers' characteristics but it could be due to the different economic and territorial environment where firms operate and by other exogenous factors.

Therefore, in this framework, it is opportune to verify the hypothesis of a territorial discrimination of lending rates potentially based on exogenous and institutional factors.

2.7 References

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Appendix 2.1: Tables

Table A2.1. Accounting indicators for default and non-default firms.

	Mean	Median
Total sample		
Sales	1,074	984
Sales growth	0.136	0.100
Total assets	1,326	821
Total debts	933	595
Equity/total assets	0.086	0.073
Total bank debts/sales	9.248	0.000
Liquidity ratio	0.974	0.820
ROA	4.768	4.130
ROE	7.935	5.340
Non default firms		
Sales	1,075	987
Sales growth	0.136	0.100
Total assets	1,325	822
Total debts	928	593
Equity/total assets	0.087	0.073
Total bank debts/sales	9.259	0.000
Liquidity ratio	0.979	0.820
ROA	4.924	4.170
ROE	8.014	5.360
Default firms		
Sales	1,016	835
Sales growth	0.093	0.000
Total assets	1,399	741
Total debts	1,254	705
Equity/total assets	0.011	0.032
Total bank debts/sales	8.572	0.000
Liquidity ratio	0.688	0.550
ROA	-3.958	1.440
ROE	1.273	3.340

Source: elaborations on AIDA data.

Table A2.2. Correlation matrix of the accounting indicators included in probit models.

	Sales	Total assets	Sales growth	Bank debts/ Sales	Equity/ Total assets	Liquidity ratio	ROA	ROE
Sales	1.00	0.28	0.04	0.08	0.02	-0.02	0.02	0.00
Total assets	0.28	1.00	0.00	0.13	0.13	-0.01	-0.14	-0.09
Sales growth	0.04	0.00	1.00	0.00	-0.04	-0.03	0.05	0.09
Bank debts/Sales	0.08	0.13	0.00	1.00	-0.05	-0.12	-0.06	-0.07
Equity/Total assets	0.02	0.13	-0.04	-0.05	1.00	0.45	0.33	0.07
Liquidity ratio	-0.02	-0.01	-0.03	-0.12	0.45	1.00	0.22	0.09
ROA	0.02	-0.14	0.05	-0.06	0.33	0.22	1.00	0.43
ROE	0.00	-0.09	0.09	-0.07	0.07	0.09	0.43	1.00

Source: elaborations on AIDA data.

Table A2.3. Correlation matrix of the macroeconomic variables included in probit models.

	GDP growth	GDP per capita	Unemployment rate	Loan growth	Cooperative banks/ Total banks	Cooperative branches/ Total branches	Banks per 10,000 inhabitants	Branches per 10,000 inhabitants
GDP growth	1.00	0.21	-0.17	0.06	-0.06	0.12	0.07	0.15
GDP per capita	0.21	1.00	-0.89	-0.29	-0.61	0.37	0.36	0.84
Unemployment rate	-0.17	-0.89	1.00	0.12	0.51	-0.33	-0.35	-0.90
Loan growth	0.06	-0.29	0.12	1.00	0.33	0.13	0.05	-0.12
Cooperative banks/ Total banks	-0.06	-0.61	0.51	0.33	1.00	0.35	0.11	-0.33
Cooperative branches/ Total branches	0.12	0.37	-0.33	0.13	0.35	1.00	0.51	0.52
Banks per 10,000 inhabitants	0.07	0.36	-0.35	0.05	0.11	0.51	1.00	0.52
Branches per 10,000 inhabitants	0.15	0.84	-0.90	-0.12	-0.33	0.52	0.52	1.00

Source: elaborations on AIDA, Bank of Italy and ISTAT data.

Table A2.4. Probit regressions (dependent variable: default).

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
Sales	-0.0001 (-1.41)	1.13E-07 (0.00)											
Sales growth rate	0.0033 (0.05)	-0.0072 (-0.10)	-0.0153 (-0.26)	-0.0065 (-0.10)	0.0027 (0.04)	-0.00003 (-0.00)	-0.0002 (-0.00)	-8.76E-06 (-0.00)	-0.0001 (-0.00)	-0.0010 (-0.02)	-0.0033 (-0.05)	-0.0008 (-0.01)	-0.0008 (-0.01)
Bank debts/Sales	-0.0071* (-1.74)	-0.0077* (-1.89)	-0.0055 (-1.63)	-0.0063 (-1.63)	-0.0045 (-1.08)	-0.0046 (-1.10)	-0.0046 (-1.10)	-0.0046 (-1.10)	-0.0046 (-1.10)	-0.0046 (-1.10)	-0.0050 (-1.17)	-0.0051 (-1.17)	-0.0051 (-1.21)
Equity/Total assets	-2.744*** (-6.24)		-2.142*** (-7.55)		-3.013*** (-6.53)	-3.025*** (-7.08)	-3.060*** (-6.54)	-3.078*** (-7.59)	-3.059*** (-6.52)	-3.059*** (-6.50)	-3.123*** (-7.54)	-3.185*** (-7.74)	-3.037*** (-6.74)
Liquidity ratio		-0.369*** (-3.44)		-0.232** (-2.19)									
ROA	-0.022*** (-3.69)	-0.040*** (-7.36)	-0.016*** (-3.38)	-0.035*** (-6.40)	-0.024*** (-3.84)	-0.025*** (-3.94)	-0.024*** (-3.84)	-0.025*** (-3.94)	-0.025*** (-3.86)	-0.024*** (-3.82)	-0.025*** (-3.91)	-0.025*** (-3.96)	-0.025*** (-3.97)
Total assets			0.00007* (1.91)	-0.00002 (-0.63)	0.00003 (0.75)	0.00008** (2.06)	0.00008** (2.22)	0.00009** (2.28)	0.00009** (2.32)	0.00009** (2.26)	0.0001*** (3.27)	0.00007* (1.82)	0.00009** (2.51)
GDP growth rate					-22.30*** (-4.38)	-21.89*** (-4.39)	-22.51*** (-4.42)	-22.45*** (-4.43)	-22.44*** (-4.41)	-21.95*** (-4.40)	-22.17*** (-4.34)	-22.54*** (-4.36)	-22.76*** (-4.52)
GDP per capita					0.000009 (0.66)		0.00001 (0.62)	0.000002 (0.11)	0.000005 (0.37)				
Unemployment rate						-0.0170 (-1.38)				-0.0094 (-0.67)	-0.0030 (-0.23)	-0.0149 (-1.13)	
Loans growth rate					-11.59*** (-6.00)	-11.88*** (-6.33)	-11.73*** (-5.85)	-12.41*** (-6.36)	-11.76*** (-5.83)	-11.87*** (-5.92)	-11.99*** (-6.22)	-11.74*** (-5.95)	-11.39*** (-5.99)
Cooperative banks/ Total banks							-0.1177 (-0.31)			-0.2249 (-0.62)			
Cooperative branches/ Total branches									-0.0746 (-0.10)			0.6653 (0.96)	
Banks per 10,000 inhabitants								0.6061 (1.42)			0.8127* (1.95)		
Branches per 10,000 inhabitants													0.0941** (2.36)

Table A2.4 (continued) - Probit regressions (dependent variable: default).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
Number of observations	36,303	36,303	36,303	36,303	36,303	36,303	36,303	36,303	36,303	36,303	36,303	36,303	36,303
Log-likelihood	-1,491	-1,465	-1,291	-1,525	-1,443	-1,436	-1,444	-1,440	-1,445	-1,444	-1,420	-1,412	-1,440
Wald Chi2	82.92	76.01	119.79	49.92	119.47	137.78	121.42	151.66	120.06	122.05	150.12	152.45	128.93
P-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Rho	0.9529	0.9664	0.9710	0.9524	0.9575	0.9595	0.9570	0.9577	0.9567	0.9572	0.9639	0.9661	0.9577
P-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.0239	0.0407	0.1549	0.0015	0.0550	0.0597	0.0542	0.0572	0.0536	0.0545	0.0701	0.0753	0.0571

Source: elaborations on AIDA, Bank of Italy and ISTAT data.

Notes: The values in brackets are the values of the z-statistic. *** variable significant at the 1%, ** at the 5%, * at the 10%.

Table A2.5. Probability of default and simulated Spreads Risk Adjusted for Italian regions (LGD = 45%).

Region	Number of observations	PD		Not weighted SRA		SRA_{1r}	SRA_{2r}
		Mean	Median	Mean	Median		
Abruzzo	877	1.38%	0.84%	0.86%	0.61%	0.96%	0.77%
Basilicata	406	2.60%	2.12%	1.51%	1.28%	1.68%	1.24%
Calabria	1,002	1.29%	0.89%	0.82%	0.63%	1.00%	0.73%
Campania	3,003	0.83%	0.61%	0.58%	0.47%	0.66%	0.51%
Emilia Romagna	2,902	1.85%	1.48%	1.12%	0.95%	1.35%	0.91%
Friuli Venezia Giulia	700	1.79%	1.42%	1.07%	0.92%	1.24%	0.94%
Lazio	3,179	1.44%	1.03%	0.91%	0.71%	1.17%	1.09%
Liguria	914	2.09%	1.83%	1.23%	1.13%	1.59%	1.14%
Lombardy	5,779	1.26%	1.01%	0.80%	0.70%	0.95%	0.79%
Marche	1,074	1.27%	1.05%	0.82%	0.72%	0.98%	0.76%
Molise	232	1.74%	0.85%	1.04%	0.61%	1.29%	1.31%
Piedmont	2,678	2.21%	1.88%	1.31%	1.16%	1.56%	1.31%
Puglia	2,167	1.56%	1.38%	0.97%	0.90%	1.03%	0.77%
Sardinia	1,135	1.74%	1.32%	1.07%	0.87%	1.20%	0.88%
Sicily	2,759	1.30%	0.70%	0.82%	0.52%	0.94%	0.66%
Tuscany	2,329	1.11%	0.88%	0.73%	0.63%	0.89%	0.66%
Trentino Alto Adige	753	1.56%	1.21%	0.97%	0.81%	1.17%	0.98%
Umbria	539	1.78%	1.31%	1.08%	0.87%	1.12%	0.95%
Valle d'Aosta	97	2.83%	2.67%	1.64%	1.56%	1.82%	1.82%
Veneto	3,139	1.35%	1.04%	0.86%	0.72%	1.03%	0.83%
North-West Italy	9,468	1.62%	1.33%	1.00%	0.87%	1.20%	1.00%
North-East Italy	7,494	1.61%	1.21%	0.99%	0.81%	1.19%	0.89%
Central Italy	7,121	1.33%	0.99%	0.85%	0.69%	1.07%	0.87%
Southern Italy	7,687	1.28%	0.83%	0.81%	0.60%	0.97%	0.81%
Islands	3,894	1.43%	0.94%	0.89%	0.66%	0.99%	0.69%
Italy	35,664	1.47%	1.07%	0.92%	0.74%	1.10%	0.88%

Source: elaborations on AIDA, Bank of Italy and ISTAT data.

Table A2.6. Bankruptcy procedures' losses on total debts and time length.

Macroarea	Year	Losses/Total debts	Bankruptcy procedures' length (in days)
North-West Italy	2002	86.4%	2,454
North-East Italy		80.2%	2,889
Central Italy		88.8%	2,485
Southern Italy		88.1%	2,910
Islands		83.0%	3,551
Italy		85.9%	2,724
North-West Italy	2003	86.2%	2,588
North-East Italy		81.8%	2,987
Central Italy		87.9%	2,649
Southern Italy		91.7%	2,870
Islands		89.5%	3,238
Italy		86.7%	2,785
North-West Italy	2004	83.1%	2,573
North-East Italy		81.7%	3,011
Central Italy		85.1%	2,780
Southern Italy		85.3%	3,185
Islands		86.9%	3,428
Italy		83.8%	2,897
North-West Italy	2005	83.4%	2,583
North-East Italy		80.8%	2,915
Central Italy		85.7%	2,882
Southern Italy		88.0%	3,199
Islands		90.6%	3,642
Italy		84.3%	2,923
North-West Italy	2006	85.9%	2,661
North-East Italy		82.7%	2,934
Central Italy		84.8%	2,964
Southern Italy		87.9%	3,197
Islands		85.8%	3,573
Italy		85.2%	2,964

Source: elaborations on ISTAT data.

Table A2.7. Probability of default and simulated Spreads Risk Adjusted for Italian regions. (*)

Region	Number of observations	PD		Not weighted SRA		SRA_{1r}	SRA_{2r}
		Mean	Median	Mean	Median		
Abruzzo	877	1.38%	0.84%	1.52%	1.10%	1.70%	1.38%
Basilicata	406	2.60%	2.12%	2.81%	2.40%	3.10%	2.32%
Calabria	1,002	1.29%	0.89%	1.59%	1.26%	1.93%	1.43%
Campania	3,003	0.83%	0.61%	1.10%	0.90%	1.26%	0.98%
Emilia Romagna	2,902	1.85%	1.48%	2.00%	1.67%	2.40%	1.61%
Friuli Venezia Giulia	700	1.79%	1.42%	1.87%	1.61%	2.17%	1.63%
Lazio	3,179	1.44%	1.03%	1.67%	1.28%	2.14%	2.00%
Liguria	914	2.09%	1.83%	2.25%	2.09%	2.91%	2.09%
Lombardy	5,779	1.26%	1.01%	1.47%	1.29%	1.74%	1.44%
Marche	1,074	1.27%	1.05%	1.50%	1.33%	1.78%	1.39%
Molise	232	1.74%	0.85%	2.02%	1.22%	2.62%	2.87%
Piedmont	2,678	2.21%	1.88%	2.37%	2.08%	2.82%	2.36%
Puglia	2,167	1.56%	1.38%	1.80%	1.69%	1.92%	1.43%
Sardinia	1,135	1.74%	1.32%	1.89%	1.53%	2.14%	1.58%
Sicily	2,759	1.30%	0.70%	1.53%	0.98%	1.76%	1.23%
Tuscany	2,329	1.11%	0.88%	1.33%	1.14%	1.63%	1.21%
Trentino Alto Adige	753	1.56%	1.21%	1.79%	1.48%	2.16%	1.81%
Umbria	539	1.78%	1.31%	1.99%	1.58%	2.07%	1.78%
Valle d'Aosta	97	2.83%	2.67%	3.09%	3.08%	3.42%	3.40%
Veneto	3,139	1.35%	1.04%	1.53%	1.25%	1.82%	1.47%
North-West Italy	9,468	1.62%	1.33%	1.82%	1.59%	2.18%	1.81%
North-East Italy	7,494	1.61%	1.21%	1.77%	1.43%	2.12%	1.60%
Central Italy	7,121	1.33%	0.99%	1.56%	1.25%	1.95%	1.59%
Southern Italy	7,687	1.28%	0.83%	1.53%	1.14%	1.84%	1.58%
Islands	3,894	1.43%	0.94%	1.64%	1.22%	1.83%	1.28%
Italy	35,664	1.47%	1.07%	1.67%	1.34%	2.01%	1.62%

Source: elaborations on AIDA, Bank of Italy and ISTAT data.

(*) To simulate the regional SRAs, the LGD has been estimated as the ratio losses/total debts in bankruptcy procedures.

Table A2.8. Probability of default and simulated Spreads Risk Adjusted for Italian regions. (*)

Region	Number of observations	PD		Not weighted SRA		SRA_{1r}	SRA_{2r}
		Mean	Median	Mean	Median		
Abruzzo	877	1.38%	0.84%	1.61%	1.19%	1.80%	1.46%
Basilicata	406	2.60%	2.12%	2.96%	2.71%	3.23%	2.52%
Calabria	1,002	1.29%	0.89%	1.76%	1.42%	2.11%	1.59%
Campania	3,003	0.83%	0.61%	1.09%	0.91%	1.23%	0.98%
Emilia Romagna	2,902	1.85%	1.48%	2.11%	1.80%	2.51%	1.71%
Friuli Venezia Giulia	700	1.79%	1.42%	1.84%	1.60%	2.13%	1.61%
Lazio	3,179	1.44%	1.03%	1.56%	1.23%	1.99%	1.84%
Liguria	914	2.09%	1.83%	2.20%	2.05%	2.84%	2.02%
Lombardy	5,779	1.26%	1.01%	1.44%	1.26%	1.68%	1.40%
Marche	1,074	1.27%	1.05%	1.75%	1.58%	2.06%	1.63%
Molise	232	1.74%	0.85%	2.10%	1.33%	2.55%	2.59%
Piedmont	2,678	2.21%	1.88%	2.27%	1.96%	2.69%	2.24%
Puglia	2,167	1.56%	1.38%	1.98%	1.90%	2.11%	1.60%
Sardinia	1,135	1.74%	1.32%	1.97%	1.63%	2.21%	1.65%
Sicily	2,759	1.30%	0.70%	1.73%	1.15%	1.97%	1.43%
Tuscany	2,329	1.11%	0.88%	1.41%	1.24%	1.71%	1.30%
Trentino Alto Adige	753	1.56%	1.21%	1.59%	1.25%	1.88%	1.58%
Umbria	539	1.78%	1.31%	2.08%	1.74%	2.13%	1.83%
Valle d'Aosta	97	2.83%	2.67%	2.87%	2.66%	3.20%	3.18%
Veneto	3,139	1.35%	1.04%	1.61%	1.35%	1.89%	1.53%
North-West Italy	9,468	1.62%	1.33%	1.76%	1.53%	2.09%	1.75%
North-East Italy	7,494	1.61%	1.21%	1.82%	1.49%	2.15%	1.61%
Central Italy	7,121	1.33%	0.99%	1.58%	1.32%	1.94%	1.61%
Southern Italy	7,687	1.28%	0.83%	1.62%	1.20%	1.93%	1.63%
Islands	3,894	1.43%	0.94%	1.80%	1.35%	2.02%	1.46%
Italy	35,664	1.47%	1.07%	1.71%	1.39%	2.03%	1.63%

Source: elaborations on AIDA, Bank of Italy and ISTAT data.

(*) To simulate the regional SRAs, the LGD has been estimated by taking into consideration both bankruptcies procedures' losses/total debts and time length. For more details, see paragraph 2.5.

CHAPTER 3: INSTITUTIONAL ENVIRONMENT AND THE COST OF MONEY IN ITALIAN PROVINCES

3.1 Introduction

The results obtained in the first essay indicate that, at a macroeconomic level, interregional differentials in the cost of money in Italy are caused both by the greater overall riskiness of loans and by factors concerning credit supply, such as the average operating size and the degree of territorial diffusion of the branch network. Nevertheless, according to the analysis developed in the second chapter (based on a representative sample of Italian firms), specific elements at firm level are not able to completely explain the interregional interest rate spread actually observed in Italy. Therefore, it is interesting to verify the hypothesis that the worse borrowing conditions in the Mezzogiorno area are due also to institutional elements.

Generally, in order to adequately assess the performance of an economic system, economists agree about the importance of the institutional environment. In other words, according to this recent paradigm, it is not possible to completely understand the economic dynamics of a system if the quality of social institutions is not taken into consideration.

Because in an efficient credit market the economic agents' results are the main factors that banks should evaluate in order to determine borrowing conditions, it is natural to hypothesize that a causal relationship between institutional environment and local lending rates also exists.

In the last years, in order to verify this assumption, the literature has increased its attention towards the relationship between social infrastructure, credit availability and borrowing conditions. The elements taken into consideration are the degree of crime, the efficiency of the court system and the effective protection of property rights. Generally, these aspects have been examined separately.

In this context, this chapter intends to verify if the quality of the institutional environment is able to influence local borrowing conditions together with the other elements taken into consideration in the previous chapters.
In order to reach this aim, it is necessary to summarize the several aspects reflecting the institutional environment in a small number of variables.
The methodology that will be applied is the principal component analysis (PCA) because it allows to sum up the information contained in a dataset composed by many variables, keeping the largest part of data variability.
The aspects of the social infrastructure examined in this work are the degree of crime, the degree of corruption and the degree of property rights protection guaranteed by the court system.
The chapter is subdivided into three paragraphs, besides this introduction. Paragraph 3.2 illustrates the main contributions that analyze the effects on economic performances and on the financial system determined by the institutional environment.
After describing the variables used in the empirical analysis, paragraph 3.3 develops an institutional index for Italian provinces during the period 2000-2003 and examines the relationship between the quality of social institutions and the cost of money. Finally, the last paragraph summarizes the main results of the chapter.

3.2 Literature review

The economic literature largely recognizes the relationship between institutional environment and economic performance.
North (1990), particularly, focused on the necessity to integrate institutions' role into economic theory. This need is caused by the presence of asymmetric information and transaction costs that make the neoclassic paradigm of complete markets only a theoretical assumption.

According to North, “*institutions consist of a set of constraints on behavior in the form of rules and regulations; and, finally, a set of moral, ethical behavioral norms which define the contours that constrain the way in which the rules and regulations are specified and enforcement is carried out […] institutions are therefore the framework within which human interaction takes place*”.

Consequently, because institutions (both formal and informal) influence transaction and production costs, according to North, they can be included among the determinants of the long run performances of economic systems.

On the basis of the North’s work, economists have traditionally focused on the direct effect of the institutional environment on GDP growth rates and on the level of economic development. These analysis are mainly based on cross-country data.

The quality of the institutions is generally measured by taking into consideration the following elements: social and human capital, corruption, crime rates and degree of property rights protection.

The general conclusion is that the quality of the institutional environment affects economic results because it is a crucial aspect to guarantee the correct implementation of operators’ transaction.

This element is particularly pointed out by **Zak and Knack (2001)** that elaborate a general equilibrium growth model with transaction costs in which heterogeneous agents face a moral hazard problem. In this context, a low degree of trust (that is caused by a insufficient level of social capital and weak formal institutions) reduces the rates of investment and growth. This hypothesis is confirmed by the empirical analysis that is based on a sample of 41 countries during the period 1970-1992.

With particular reference to the Italian context, the main contributions about the relationship between social infrastructure and economic performance are Aiello and Scoppa (2000), Del Monte and Papagni (2001), Golden and Picci (2005), Daniele and Marani (2008) and Albanese (2010).

Taking into consideration the period 1980-1982, **Aiello and Scoppa (2000)** explain the regional differences in the levels of output per worker according to the greater degree of total factor productivity (TFP) observed in Northern regions. Particularly, the TFP is also influenced by the institutional environment because it depends on the degree of development of the financial system, the agglomeration economies, the efficiency of infrastructures, the degree of crime and the government intervention in the economy (that is expressed in terms of incidence of public employment in the labour market).

Del Monte and Papagni (2001) verify if corruption can be included among the causes of the failure of the huge program of public expenditure that has been carried out during the last fifty years in favor of the Mezzogiorno regions. Particularly, this program has not been able to reduce the distance between Northern and Southern regions in terms of GDP per capita.

On the basis of data concerning the Italian regions during the period 1963-1991, the authors show a negative effect of corruption (measured in terms of the number of crimes against the public administration per million employees) on GDP per capita. This relationship is due to the reduction of the quantity and the quality of infrastructures and public services provided to the private sector that is caused by corruption and, hence, to a lower degree of efficiency of the public expenditure in the regions characterized by a high level of corruption.

For the year 1997, **Golden and Picci (2005)** develop a specific indicator of corruption for Italian provinces. This measure is obtained by calculating the difference between the amounts of physically existing public infrastructure and what government cumulatively pays for public infrastructure (that represents the potentially feasible stock of public capital). The hypothesis underlying the significance of this index is that, for the most part, this difference is caused by the loss of public money for fraud and embezzlement activities. Golden and Picci point out that, although the amount of public investments is greater in

Southern regions, Northern regions are more infrastructure-abundant. This result indicates a greater degree of corruption in the Mezzogiorno area.
Taking into consideration the period 2004-2006, **Daniele and Marani (2008)** show that organized crime negatively affects the Mezzogiorno attractiveness and, generally, the overall potential investors' opinion about Southern regions. Organized crime (measured by the number of extortions, people denounced for criminal conspiracies, attempts and arsons per inhabitant) negatively influences foreign direct investments in the Mezzogiorno area because it represents an additional cost for private firms.
Finally, **Albanese (2010)** develops a cross-section analysis for Italian regions during the year 2004. The aim of this work is to estimate an indicator that takes into consideration the main aspects of the social infrastructure (corruption, crime, efficiency of the court system and degree of intervention in the economy) and that is able to explain differences between North and South Italy in the level of GDP per capita.
According to the author, the differences among Italian regions in the level of economic development are caused by an institutional gap among Northern and Southern areas, while the traditional impact of social and human capital on the level of GDP per capita observed by the literature is not any more significant when the role played by social infrastructure is taken into account.
During the last years, another research field has been represented by the study of the relationship between institutional environment and economic system by means of the credit market's and financial system's channels.
Particularly, because the cost and the availability of financial resources influence the investors' investment ability, these aspects are crucial factors for the economic growth processes above all in those contexts characterized by the dominant presence of small firms for which external financial resources are the main source of funding.

The group of works that analyze the relationship between institutional environment and financial system includes Mauro (1995), La Porta et al. (1998), Claessens and Laeven (2003), Diamond (2004), Qian and Strahan (2007) and Bae and Goyal (2009) and, for the Italian context, Guiso et al. (2004), Jappelli et al. (2005) and Bonaccorsi di Patti (2009).

Taking into consideration a panel of 32,665 households during the period 1989-1995, **Guiso et al. (2004)** focus on the relationship between institutional environment and degree of development of the financial system.

The aspects of the social infrastructure analyzed by these authors are the degree of crime (expressed by the number of violent crime divided by the population), the degree of inefficiency of the law enforcement (measured by the average length of the first-degree trials), the human capital (expressed in terms of average number of schooling years) and the social capital (measured by the participation in referenda and by the number of blood donations every 1,000 inhabitants, i.e. by behaviors that are not caused by economic reasons but are driven only by social pressure and internal norms).

With particular reference to the latter aspect, social capital should influence the level of development of the financial system because the probability that a contract takes place depends not only on its legal enforceability but also on the degree of trust among the agents, that is positively influenced by social capital.

A greater development of the financial system is expressed by a larger incidence of the households that use checks, portfolio allocation, face less constraints to obtain bank loans and do not depend on informal lending (i.e. on loans that are made by relatives and friends and that are considered as an alternative to bank credit if banks reject the household's credit request).

The authors show that the level of development of the financial system is greater in the areas characterized by larger levels of human and social capital, a better efficiency of the court system and a smaller presence of organized crime.

Particularly, social capital significantly affects the use of checks, the probability to face constraints in the credit market and the probability to ask for informal lending only in the areas with a smaller efficiency of the judicial system. Consequently, in areas characterized by a low contracts' enforceability (that is caused by a low degree of efficiency of the court system), the role played by social capital is more relevant because social capital imposes internal norms and social sanctions that are able to reduce opportunistic behavior on the part of borrowers.

Furthermore, social capital significantly influences the borrowers' probability to be financed by banks in the areas with a low average level of education. The reason is that, low-education people involved in the transaction cannot fully understand most of the terms of the contracts; consequently low-education people will delegate more educated agents to conclude the transaction and they will require more trust.

Jappelli et al. (2005) have a different approach concerning how the degree of efficiency of the court system influences credit availability.

In more details, this work develops a theoretical model where agents transact and face a moral hazard problem and the court system is inefficient. According to this model, an improvement in the degree of efficiency of the judicial system leads to a reduction of credit rationing because of the greater protection of banks' rights in case of default. This hypothesis is confirmed by an empirical analysis based on data about the 27 Italian judicial districts (that existed during the nineties of the last century) during the period 1984-1998. Particularly, the degree of efficiency of the court system (measured by the average length of the civil judicial processes and the number of civil suits pending per 1,000 inhabitants) positively affects credit availability; on the contrary a greater degree of efficiency of the judicial system determines lower lending rates and a smaller number of default events.

This result is also obtained by **Bonaccorsi di Patti (2009)** that, developing a cross-section analysis at a provincial level on 300,000 bank-firm relationships in 2000, shows that access to credit is positively affected by the degree of efficiency of the court system.

The institutional aspects taken into consideration by Bonaccorsi di Patti reflect, at a provincial level, the level of crime (number of offences for which the authorities have opened a judicial procedure per 1,000 inhabitants and the share of offences against individuals reported to law enforcement officers) and the inefficiency of the judicial system (expressed in terms of length in years of a first-degree civil court trial used in Guiso et al. (2004)).

According to the author, lending rates are higher in the areas where crime rates are larger and courts are inefficient; on the contrary, where there is more trust in institutions, borrowing conditions are better. Particularly, borrowers operating in the provinces with a larger degree of crime must pay lending rates that are around 30 basis points higher than those paid by similar borrowers operating in low-crime provinces. The effect of crime on the cost of money decreases for larger firms.

Furthermore, crime rates positively affect the collateral amount and the probability that the utilization rate ratio (i.e. the ratio between used and granted credit) is bigger than 1, denoting the existence of credit rationing.

As regards the international framework, taking into consideration data on 70 countries during the period 1980-1983, **Mauro (1995)** examines the relationship between institutional environment and economic performance by means of the investment channel. According to the author, corruption and inefficiency of bureaucracy slowdown investments and, by this way, reduce GDP growth rates.

La Porta et al. (1998) analyze the relationship between legal protection of investors (both companies' creditors and shareholders) and corporate governance models.

In this context, by examining data on a set of 49 countries during the nineties of the last century, the authors show that in French-civil-law countries (where investors' legal protection is the lowest one) the ownership is extremely concentrated. This result support the idea the more concentrated ownership is considered as an instrument that allows to investors to actually exercise their control rights in an adverse institutional environment. On the contrary, in common-law countries (that are the countries with the highest investors' legal protection) the ownership is generally not concentrated.

By analyzing a sample of 45 countries during the period 1980-1989, **Claessens and Laeven (2003)** focus on the relationship between property rights protection and resources allocation by firms.

According to the authors, firm growth is influenced, besides the financial resources availability, also by the allocation of investable resources.

Particularly, property rights protection is able to affect the allocation of resources across alternative investment projects because firms operating in markets with weaker property rights tend to invest a share of their financial resources in material assets that is larger than the optimal one. The reason is that, in these frameworks, firms find relatively less difficult to secure the returns from fixed assets from illegal behaviors on the part of their competitors.

The empirical analysis confirms this hypothesis: the authors show that a greater development of the financial system (measured by the ratio between private loans and GDP) and a better legal protection system (expressed by taking into consideration several indexes that were developed by international agencies according firms' surveys) facilitate firms' growth by increasing financial resources availability and the efficiency of resources allocation by firms.

Qian and Strahan (2007) examine a sample of 4,321 bank loans in 43 countries during the period 1994-2003 and come at the conclusion that the institutional environment (measured by the degree of creditor rights protection) significantly affects contract terms and the degree of loan concentration.

In details, in those contexts with better legal protection, banks generally grant credit at better conditions (lower lending rates and longer maturities). The reason is that, in these realities, banks have greater ability to force repayment or take control of the firm in case of default.

Furthermore, on average, the number of lenders is lower (i.e. the concentration of loan ownership is bigger) in countries with a larger degree of property rights protection and for smaller and opaque firms.

Finally, because of the significant presence of asymmetric information, foreign banks are more sensitive to the legal environment: a reduction of the degree of creditor rights protection leads to a decline in foreign banks' market shares in favor of domestic banks.

Bae and Goyal (2009) point out that borrowing conditions are not influenced by the formal creditor rights protection system but by the actual enforceability of bank contracts.

On the basis of a sample of 63,158 bank loans in 48 countries during the period 1994-2003, these authors show that banks apply more cumbersome conditions in those countries where the degree of creditor rights protection is worse in response to the greater uncertainty of the legal environment. Particularly, in these contexts, banks tend to reduce loans maturity in order to review their lending decisions more frequently and apply higher interest rates to compensate the greater credit risk. Moreover, Bae and Goyal show that firms with similar structural characteristics pay larger lending rates if they operate in countries characterized by higher levels of corruption, greater risk of expropriation and larger risk of contract repudiation.

Finally, **Diamond (2009)** develops a theoretical analysis. The author elaborates a model where short loans' maturities represent a solution in those contexts where creditors must sustain higher costs in order to enforce debt contracts.

If loans' maturities are short and firms borrow from multiple lenders, borrowers will repay their debts also if enforcement is costly and single lenders could be induced not go to bankruptcy court after a borrower default. The reason is that, in this case, borrowing with large amounts of short-term debts from different lenders can lead to the threat of “firm runs” that are very similar to the bank runs during liquidity crisis. This threat is able to commit borrowers to repay debt rather than renegotiate the claim at the maturity.

According to Diamond, the minimum number of lenders that is necessary to commit borrowers to repay debt increases with enforcement costs that are positively influenced by the degree of corruption in the legal system and negatively affected by the degree of creditor rights protection.

3.3 The empirical analysis: estimating an institutional index for Italian provinces

3.3.1 Institutional environment and the cost of money

According to the literature illustrated in the previous paragraph, institutional environment is an aspect able to significantly affect potential growth both directly and indirectly by means of the financial channel (i.e. institutional elements affect the functioning of the financial system and, consequently, the operators’ investment ability).

In this framework, this chapter intends to verify if, in Italian provinces, social infrastructure is able to significantly influence borrowing conditions. In order to reach this aim, the quality of the institutions must be expressed in quantitative terms.

Social infrastructure can be expressed by means of various factors. Particularly, literature traditionally has taken into consideration the following aspects: crime, degree of legal protection assured by the court system and corruption.

With particular reference to the first element, in high-crime areas, banks can apply to their customers more cumbersome borrowing conditions because of the greater perceived risk. In this situation, firms must indeed face the risk of losses

caused by criminal activities (such as extortions) and must sustain additional costs for security and protection.
The negative effect of crime in a territory can be alleviated by an efficient judicial system. Coherently with Bae and Goyal's results, borrowing conditions are not influenced by formal creditor rights protection but by the actual contracts' enforceability. In this context, an efficient court system allows to operators to enforce contracts without time and financial resources waste.
A greater efficiency of the judicial system should improve borrowing conditions by means of two channels. The first one is the disincentive to illegal behaviors that determines the reduction of the average crime rate. The second channel is the increase in the bank contracts' enforceability and in the probability that bank credits are totally repaid by borrowers. In light of the latter element, it appears very important to take into consideration, together with data concerning penal and civil justice, also data about bankruptcy procedures.
Finally, as regards the last aspect of the social infrastructure traditionally analyzed by the literature, corruption can affect the accurate functioning of the financial system because it distorts the whole economic system and the price mechanisms.

3.3.2 The Italian judicial system

The following analysis concerns the period 2000-2003 and is based on provincial data about civil and penal justice and bankruptcy proceedings provided by the Territorial Information System of Justice developed by ISTAT.
I chose to take into consideration this period because of the limited availability of data about justice at a provincial level: in fact, ISTAT releases the main data about the court system in Italian provinces from 2000 to 2005. However, in order to estimate an institutional indicator, I chose to take into account only the period 2000-2003 because this work intends to analyze the relationship between institutional environment and the cost of money and homogenous data on

lending rates are available exclusively during the period 1998-2003 (during the period 2000-2003 both data on judicial system and homogenous data on lending rates are hence available).

As regards the civil and penal justice, the variables included into the analysis are those traditionally taken into consideration by the literature in order to assess the effect of the social institutions on economic performance: the average length in days of a first-degree civil court trial, the number of civil suits pending per 100,000 inhabitants, the ratio between the number of civil suits pending and settled during the year (this indicator is an inverse measure of the courts' ability to dispose of civil trials) and the number of total crimes, crimes against the State, criminal associations and mafia criminal associations (per 100,000 inhabitants) for which the judicial authority began the penal action.

Furthermore, I included into the analysis also a variable concerning bankruptcy proceedings (that is a field that traditionally has not been taken into consideration by the literature). Particularly, the indicator analyzed is the ratio between losses and liabilities because it reflects the average amount that creditors can obtain in bankruptcies procedures. This ratio can be considered such as a proxy of the degree of contracts' enforceability and, hence, of the degree of property rights protection in the system.

As data demonstrate, in Italy there are relevant differences, among the different geographical areas, in the degree of efficiency of the court system, crime and corruption.

Table 3.1 confirms that Mezzogiorno is the geographical area with the highest level of organized crime (the legend of the indicators is shown in table A3.1 in appendix 3.1). Particularly, the differences among areas in terms of number of criminal associations and extortions per 100,000 inhabitants are very significant given that these types of offences are linked to organized crime. In Southern Italy and in the Islands, indeed, both indicators take values considerably larger than those observed in the other geographical areas and indicate the bigger incidence of organized crime in Southern regions.

Table 3.1. Average values of variables on the Italian justice system for geographical area during the period 2000-2003.

Variable	North-West	North-East	Central Italy	Southern Italy	Islands	Italy
Average_length	769	900	970	1,302	1,281	1,032
Civil_trials_pending_10000	1,385	1,533	2,602	2,818	2,467	2,120
Civil_trials_pending_settle	1.80	2.17	2.08	2.77	2.96	2.31
Crimes_action_100000	5,734	3,408	5,491	4,493	4,614	4,822
Crimes_state_100000	80.18	64.65	127.82	140.43	144.20	108.49
Extortions_100000	4.84	3.87	5.59	9.16	8.77	6.31
Criminal_associations_100	1.38	1.37	1.80	3.18	3.44	2.14
Loss_liabilities	86.12	77.05	87.53	86.94	85.86	84.80

Source: elaborations on ISTAT data.

Analogously to Del Monte and Papagni (2001), the number of crimes against the State per 100,000 inhabitants for which the judicial authority began the penal action is considered such as a proxy of corruption in the public administration. In Southern Italy and in the Islands this indicator is equal, respectively, to 140.43 and 144.20 (while it takes a value of 108.49 at national level). These data indicate that in the Mezzogiorno area there exists a higher level of corruption in the bureaucracy and in political institutions with respect to the other areas.

Furthermore, Southern Italy and the Islands are the areas with the greatest average length of first-degree civil court trials (in these areas, these types of trials last, respectively, 1,302 and 1,281 days versus a national average of 1,032 days).

According to Carmignani and Giacomelli (2009), during the period 2000-2005 the larger litigation rate in the Mezzogiorno area is associated to bigger resources in terms of judges in civil courts even by taking into account the differences in the number of proceedings in the different areas. Nevertheless, these data do not consider the heterogeneity (i.e. the different level of difficulty) of trials in the areas. Consequently, it is not possible to understand if the greater

quantity of pending trials in the Mezzogiorno area is caused by inadequate resources or by courts' lower degree of productivity.
However, the greater average length of civil trials and the bigger quantity of pending trials determine a lower degree of rights protection in Southern regions.
Instead, the geographical distribution of the ratio between losses and liabilities in bankruptcy proceeding (that can be considered such as a proxy of the loss given default) is more homogenous among provinces.
The main conclusion to be drawn by analyzing data on the justice system is that Mezzogiorno is the Italian area with the worst quality of the institutional environment because of the highest degree of crime, corruption and the lowest rights protection assured by the court system.

3.3.3 Estimating an institutional indicator for Italian provinces

Data discussed in the previous paragraph show that the degree of corruption, crime and rights protection (indicators that reflect the quality of the institutions) can be represented by several variables that tend to move in the same direction.
Although in order to represent the different characteristics of the institutional environment it is important to take into consideration as many variables as possible, the inclusion of too many correlated variables would not allow to properly assess the importance of each element.
In order to overcome this trade-off, principal component analysis (PCA) is employed. This methodology allows to express the information contained in a dataset composed by a large number of highly correlated variables by using few indicators. Appendix 3.2 explains this methodology in more details.
The PCA is hence applied to the eight variables analyzed in the previous paragraph in order to calculate one or more indicators that are able to efficiently summarize the information contained in the dataset.
The indicators obtained by means the PCA are linear combinations of the eight variables, with weights equal to the elements of the corresponding eigenvectors

of the correlation matrix of the initial variables involved. These weights permit to account for the largest part of data variability (see appendix 3.2).

PCA is based on the correlation matrix rather than the variance and covariance matrix because the eight variables object of analysis have different order of magnitude. Because the variance depends on the absolute value of the variables, considering in the PCA the variance and covariance matrix rather than the correlation one would lead to components that are considerably affected by the variables with the largest absolute values; on the contrary the information contained in the variables characterized by a large variability but low absolute values would be lost. In other words, if the analysis developed in this paragraph would have been based on the variance and covariance matrix of the original variables, the calculated components would be a combination of the number of offences per 100,000 inhabitants for which the authorities opened a judicial procedure and the number of civil suits pending per 100,000 inhabitants (i.e. the variables with the highest order of magnitude), while the weights associated to the other six variables would be approximately equal to zero.

The eigenvalues of the correlation matrix are shown in table A3.2 in appendix 3.1. For every component, the corresponding eigenvalue represents its variance, while the ratio between the eigenvalue and the total sum of all eigenvalues is the percentage of the dataset variance that is explained by the component taken into consideration (see appendix 3.2).

Table A3.2 shows that the first component explains 42.6% of the overall variance with an eigenvalue equal to 3.41. Taken together, the first two components explain almost 60% of the variance.

In order to summarize the information contained in the dataset, only the first two components are considered. The choice of the number of components to take into account is based on the Kaiser rule, according to which only the main components corresponding to an eigenvalue which is higher or equal to 1 have to be selected.

With reference to the first component, the eigenvector (reported in table A3.3) shows how the number of civil suits pending, the ratio between the number of civil suits pending and settled, the number of crimes against the State and the average length of first-degree trials have similar weights. The number of crimes for which the judicial authority began the penal action is instead the least important variable to compute this component.

In more details, the first component is obtained by calculating the linear combination of the initial eight variables on the Italian justice system, with weights equal to the elements of the eigenvector corresponding to the highest eigenvalue (that is equal to 3.41).

Because all weights associated to the initial eight variables have positive sign, the first component can be considered such as an indicator of the quality of the institutional environment at provincial level. Particularly, provinces with larger and positive values of the first component are the areas where the eights variables on the justice system are larger and, therefore, are characterized by a worse quality of the institutions.

As regards the second component, variables concerning the civil justice and variables concerning the penal justice and bankruptcy proceedings have opposite sign. Therefore, provinces where the second component takes larger and positive values are characterized by a greater degree of inefficiency in the civil justice system.

Analogously to the first component, the second one is computed by weighting the eight original variables concerning the court system in Italian provinces with weights equal to the elements of the eigenvector associated to the second eigenvalue (that is equal to 1.32).

The initial values of the two components are rescaled so that the range for each indicator is between 0 and 1 with low values indicating higher average quality levels of the institutional environment in Italian provinces during the period 2000-2003.

For every year of the period object of analysis, the following table shows the first and the last 10 provinces according to the first component (that, as I pointed out before, can be considered such as an indicator of the social infrastructure).
The first section of table 3.2 suggests the presence of a worse institutional environment in the Mezzogiorno area.

Table 3.2. Ranking of Italian provinces according to the value of the first component.

First 10 Italian provinces according to the value of the first component							
2000		2001		2002		2003	
Province	Value	Province	Value	Province	Value	Province	Value
Messina	0.94	Messina	1.00	Avellino	0.83	Catanzaro	0.81
Massa Carrara	0.93	Avellino	0.90	Catanzaro	0.81	Avellino	0.77
Catanzaro	0.87	Catanzaro	0.90	Messina	0.74	Messina	0.66
Avellino	0.81	Massa Carrara	0.87	Salerno	0.64	L'Aquila	0.62
Benevento	0.80	Rome	0.72	L'Aquila	0.64	Salerno	0.60
Rome	0.71	Salerno	0.70	Benevento	0.61	Massa Carrara	0.60
Reggio Calabria	0.71	Benevento	0.70	Potenza	0.60	Potenza	0.58
Siracusa	0.71	Latina	0.68	Massa Carrara	0.57	Prato	0.55
Salerno	0.70	L'Aquila	0.66	Rome	0.57	Rome	0.55
L'Aquila	0.68	Naples	0.62	Crotone	0.53	Benevento	0.54
Last 10 Italian provinces according to the value of the first component							
2000		2001		2002		2003	
Province	Value	Province	Value	Province	Value	Province	Value
Pavia	0.12	Como	0.11	Arezzo	0.09	Arezzo	0.09
Verbano Cusio Oss.	0.11	Cremona	0.10	Como	0.08	Cremona	0.08
Arezzo	0.11	Novara	0.10	Lecco	0.07	Bolzano	0.08
Sondrio	0.10	Verbano Cusio Oss.	0.10	Vercelli	0.06	Como	0.07
Pordenone	0.10	Pordenone	0.09	Novara	0.06	Trento	0.07
Bolzano	0.09	Trento	0.04	Verbano Cusio Oss.	0.05	Novara	0.05
Varese	0.08	Cuneo	0.04	Cuneo	0.05	Lecco	0.05
Trento	0.07	Sondrio	0.04	Sondrio	0.03	Cuneo	0.05
Cuneo	0.05	Varese	0.03	Trento	0.03	Sondrio	0.04
Lecco	0.00	Lecco	0.01	Varese	0.03	Varese	0.02

Source: elaborations on ISTAT data.

Indeed, among the first 10 provinces according to the value of the first component, there are, almost exclusively, provinces localized in Southern regions. Campania is the region with the most serious institutional problems:

particularly, in every year of the period taken into consideration, in this region 3 provinces out of 5 (Avellino, Benevento and Salerno) are ranked among the 10 Italian provinces with the highest values of the first component.

On the contrary, the second part of table 3.2 shows that Northern provinces have the best results. In fact, with the exception of Arezzo, the provinces characterized by the lowest values of the first component are localized in North Italy. Particularly, the Lombardy provinces have the best performance in terms of social infrastructure.

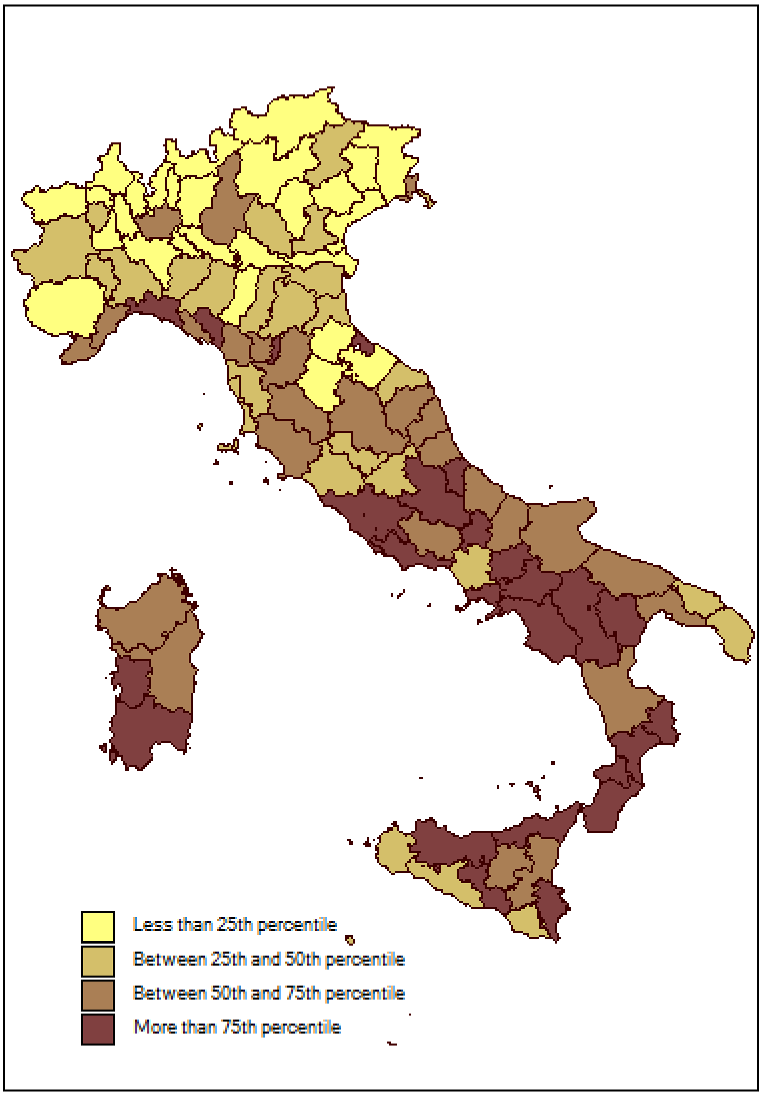
The better institutional environment in Northern areas is confirmed in figure 3.1. This figure allows to assess the overall distribution of Italian provinces according to the average value of the first component during the period 2000-2003.

Provinces with lighter colours are characterized by a better quality of the institutions while the areas with darker colours are less virtuous.

Southern provinces generally belong to the highest quartiles of the distribution; on the contrary, provinces located in the Northern and Central Italy are characterized by smaller values of the indicator. Milano and Brescia are the only Lombardy provinces that do not belong to the first quartile of the distribution.

In conclusion, the analyzed data point out relevant differences in the quality of the institutions among Northern and Southern areas. The worse institutional environment in the Mezzogiorno area is caused by the higher organized crime and by the difficulties of the Southern courts to solve civil disputes and bankruptcy proceedings. On the whole, these elements cause a lower rights protection in the Mezzogiorno and are able to negatively influence borrowing conditions applied to the firms operating in this area.

Figure 3.1. Indicator of the quality of the institutional environment in Italian provinces (1)



Sources: elaborations on ISTAT data.

(1) For each province, the index of the quality of the institutional environment has been obtained by calculating the average value of the first component during the years 2000-2003.

3.3.4 Does institutional environment affect borrowing conditions in Italian provinces?

In light of the analysis developed in the previous paragraph, the aim of this section is to verify if the higher lending rates applied to Southern borrowers are caused, together with the structural elements concerning the financial system examined in the first chapter, also by institutional factors.

In details, the following analysis intends to examine the impact on borrowing conditions of social infrastructure at a provincial level.

In order to quantitatively express the level of the institutional environment, I employ the first two components computed in the PCA developed in paragraph 3.3.3. I chose to take into consideration also the second component because, together with the first one, it allows to express about 60% of the overall variability of the information contained in the initial eight variables that reflect the degree of crime, corruption, efficiency of the court system and rights protection.

Analogously to the analysis developed in the first chapter, because of the relevant persistence in lending rates, it would be appropriate to explain the relationship between social infrastructure and the cost of money by using a dynamic panel model. In this context, the Arellano and Bond estimator would lead to consistent and efficient estimates.

However, while homogeneous data on lending rates are available for 6 years (from 1998 to 2003), it is possible to employ data on the judicial system only for 4 years (from 2000 to 2003). If I would have included 2 lags for the dependent variable and used first differences (according to the Arellano and Bond methodology), the number of the remaining observations for each series would not permit to obtain estimates for the Arellano and Bond estimator.

In light of the above considerations, the following analysis develops a set of cross-section models where, for every province, the dependent variable is the average of lending rates during the period 2000-2003 and the explanatory variables are the average values of the first and the second component and the average values of the variables concerning the banking system that, according to the first chapter, significantly affect the cost of money at a macroeconomic level: the degree of territorial diffusion and the average operating size of the branch network and the riskiness of loans.

Because of the high negative correlation between the average value of the number of branches per 10,000 inhabitants and the average value of the ratio between non-performing loans and total loans (as shown in table A3.4, the correlation coefficient between these variables is equal to -0.82), the effect of these two variables on lending rates is evaluated separately in order to avoid multicollinearity problems.

Table 3.3 shows the output of the estimated OLS regressions together with the Breusch-Pagan heteroskedasticity test and the Ramsey Regression Equation Specification Error Test (RESET test).

With reference to the first model, the Breusch-Pagan test leads to reject the null hypothesis of homoskedastic errors. Consequently, the inferential analysis is developed by using the White heteroskedasticity consistent standard errors.

Coherently with the results achieved in the first chapter, the first model indicates a significant and negative relationship between the average operating size of branches and lending rates; on the contrary the aggregate riskiness of loans positively affects the cost of money.

As regards the institutional aspects, provinces with higher values of the first component are characterized by more cumbersome borrowing conditions (large values of the first component reflect worse institutional environments). Particularly, the coefficient associated to the first component indicates that a reduction of 0.53 in this variable (this value is the difference between the median and the maximum values of the first component) leads to a decrease of 72 basis points in the provincial lending rate.

Table 3.3. Regression output
(dependent variable: lending rates average) (1)

Variables	Model 1	Model 2	Model 3	Model 4
Pc1_average	1.362*** (4.38)	0.973*** (3.67)	0.963*** (3.44)	0.928*** (3.29)
Pc2_average	-0.079 (-0.26)	0.004 (0.02)	-0.111 (-0.40)	0.127 (0.45)
Loans/Branches_average	-0.036*** (-6.75)	-0.045*** (-8.92)	-0.039*** (-8.06)	-0.041*** (-8.81)
Bad debts/Totale loans_average	0.070*** (5.15)			
Branches_average		-0.259*** (-8.80)	-0.255*** (-8.98)	-0.243*** (-8.26)
Share of firms operating in agricolture_average			0.012** (2.63)	
Share of firms operating in manufacturing_average				-0.025** (-2.34)
Constant	6.898*** (22.06)	9.207*** (29.53)	8.859*** (24.63)	9.272*** (27.44)
Number of observations	103	103	103	103
R squared	0.7546	0.8042	0.8172	0.8146
Adjusted R squared	0.7446	0.7962	0.8077	0.8050
F	80.33	101.69	86.71	85.24
Prob > F	0.0000	0.0000	0.0000	0.0000
Breusch-Pagan test				
chi2(1)	5.93	0.30	1.26	0.81
Prob > chi2	0.0149	0.5850	0.2620	0.3673
Ramsey RESET test				
F	1.46	2.63	1.32	1.64
Prob > F	0.2293	0.0544	0.2729	0.1859

Source: elaborations on Bank of Italy and ISTAT data.

(1) The values in brackets are the values of the t-statistic based on White heteroskedasticity consistent standard errors. *** variable significant at the 1%, ** at the 5%, * at the 10%.

There is not instead a significant relationship between the second component and lending rates.

According to the second model, the cost of money is negatively affected both by the operating size and the degree of territorial diffusion of the branch network; furthermore, the presence of a positive and significant relationship between the indicator of the quality of the institutional environment and lending rates is confirmed.

The RESET test leads do not reject the null hypothesis that the model has no relevant omitted variables at 5% level of significance.

Furthermore, departing from model 2, I estimated other two specifications in order to take into consideration also the differences, among provinces, in firms' industry composition.

Particularly, models 3 and 4 include, respectively, the share of firms operating in agriculture and manufacturing. By taking into consideration these two variables, it should be possible to assess, in the same specifications, the impact on lending rates of the territorial diffusion of branches and loans' riskiness. In fact, according to several authors, the overall riskiness of loans in an area is significantly influenced by the size and industry composition of the bank customers[18].

A simple correlation analysis seems to confirm this assumption: higher ratios between bad debts and total loans are associated with a large incidence of the agriculture sector and a smaller share of firms operating in manufacturing (see table A3.4). Because these two variables are not highly correlated with the number of branches per 10,000 inhabitants, multicollinearity problems are avoided.

Models 3 and 4 substantially confirm the results obtained in the first two models: the cost of money is negatively affected by branches' operating size and territorial diffusion, while improvements in the quality of the institutional framework lead to better borrowing conditions. Moreover, the industry composition of the bank customers (that reflects also the overall loans' riskiness according to the Panetta's opinion) significantly influences lending rates (provinces with a higher incidence of the agriculture sector are characterized by

[18] For example, Panetta (2003), *Evoluzione del sistema bancario e finanziamento dell'economia nel Mezzogiorno*, in "Temi di Discussione della Banca d'Italia", No. 467.

worse borrowing conditions, while the share of firms operating in manufacturing negatively affects lending rates).

The Breusch-Pagan and the RESET tests allow do not rejecting the hypothesis of homoskedastic errors and correct specification for both model 3 and 4.

On the whole, according to the estimated models, the effect of a decrease of the first component from the maximum value observed in the province of Catanzaro (0.85) to the minimum value noticed in the province of Lecco (0.03) amounts to a reduction in the cost of money between 76 and 112 basis points. This result is rather important because the actual difference among the lending rates observed in these provinces is equal to 262 basis points.

The developed analysis indicates hence that, in order to adequately understand the differences in the cost of money among the Italian provinces, it is necessary to take into consideration, together with the features of the banking system, also the quality of the institutional environment in different areas.

3.4 Conclusions

The economic literature widely recognizes that the quality of the institutions positively affects economic performance.

Because the availability of financial resources determines the overall investment ability in a system, it is important to understand if institutional environment also influences local borrowing conditions.

Indeed, the quality of the institutions (measured by taking into consideration the degree of corruption, crime, rights protection and efficiency of the court system) is able to influence the conditions at which banks grant loans because it represents a crucial aspect to assure the accurate functioning of every economic transaction. In other words, banks tend to require an additional premium in those areas characterized by a worse social infrastructure because this premium allows facing the greater probability that borrowers will not repay their debts because of exogenous factors that increase their fragility.

The analysis developed in this chapter aimed to verify the significance of the relationship between the quality of the institutions and the cost of money in Italy.

In order to reach this aim, by means of the principal component analysis I elaborated an indicator at a provincial level that expresses the quality of the institutions on the basis of data concerning the general crime (measured by the number of crimes for which the judicial authority began the penal action per 100,000 inhabitants), the organized crime (expressed in terms of extortions and criminal associations per 100,000 inhabitants), the level of corruption (measured by the number of crimes against the State per 100,000 inhabitants) and the degree of rights protection (expressed by the ratio between losses and liabilities in bankruptcy proceedings, the average length of civil disputes, the number of first-degree civil pending suits and the ratio between first-degree civil suits pending and settled during the year).

Although politically unified since 150 years, Italy is a country where social and economic gaps remain large among Northern and Southern areas. Organized crime is particularly heavy in the Mezzogiorno area, where the incidence of extortions and criminal associations continues to be significantly larger with respect the other geographical areas.

According to the estimated models, the quality of the institutions negatively influences lending rates even if the structural features of credit supply and demand at provincial level are taken into account.

The effect on provincial lending rates of an improving in the indicator of the quality of the institutions is significant. The effect of a reduction of this indicator from the maximum value observed in the province of Catanzaro to the minimum value in the province of Lecco is a significant improving of borrowing conditions (the reduction of lending rates is comprised between 76 and 112 basis points).

Consequently, the more cumbersome borrowing conditions applied to the Southern bank customers are influenced, together with the greater aggregate riskiness of loans and elements concerning credit supply (the lower operating size and territorial diffusion of the branch network) also by the worse quality of the institutional environment in the Mezzogiorno area.

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Appendix 3.1: Tables

Table A3.1. Legend of the variables used in the PCA.

Variable	Description
Average_length	Average length in days of a first-degree civil court trial
Civil_trials_pending_100000	First-degree civil suits pending per 100,000 inhabitants
Civil_trials_pending_settled	Ratio between first-degree civil suits pending and settled
Crimes_action_100000	Total crimes for which the judicial authority began the penal action per 100,000 inhabitants
Crimes_state_100000	Crimes against the State for which the judicial authority began the penal action per 100,000 inhabitants
Extortions_100000	Extortions for which the judicial authority began the penal action per 100,000 inhabitants
Criminal_associations_100000	Criminal associations and mafia criminal associations for which the judicial authority began the penal action per 100,000 inhabitants
Loss_liabilities	Ratio between losses and liabilities in bankruptcy proceedings

Table A3.2. Explained total variance.

Component	Eigenvalue	Percentage of explained variance	Cumulative percentage of explained variance
1	**3.41**	**42.64**	**42.64**
2	**1.32**	**16.56**	**59.20**
3	0.97	12.10	71.30
4	0.85	10.67	81.97
5	0.69	8.65	90.61
6	0.37	4.61	95.22
7	0.30	3.81	99.03
8	0.08	0.97	100.00

Source: elaborations on ISTAT data.

Table A3.3. Principal components eigenvectors.

Variable	Pc1	Pc2
Average_length	0.473	0.350
Civil_trials_pending_100000	0.451	0.147
Civil_trials_pending_settled	0.434	0.408
Crimes_action_100000	0.118	-0.553
Crimes_state_100000	0.387	-0.416
Extortions_100000	0.323	-0.169
Criminal_associations_100000	0.279	-0.425
Loss_liabilities	0.196	-0.048

Source: elaborations on ISTAT data.

Table A3.4. Correlation matrix. (*)

	Rates	Pc1	Pc2	Loans/ Branches	Branches	Bad debts/ Total loans	% firms in agricult.	% firms in manuf.
Rates	1.0000	0.5284	0.1780	-0.6128	-0.7429	0.7862	0.4756	-0.5410
Pc1	0.5284	1.0000	-0.1828	-0.0176	-0.6142	0.5213	0.0355	-0.2833
Pc2	0.1780	-0.1828	1.0000	-0.3703	-0.0491	0.2021	0.3270	0.0312
Loans/ Branches	-0.6128	-0.0176	-0.3703	1.0000	0.1942	-0.4532	-0.5596	0.3852
Branches	-0.7429	-0.6142	-0.0491	0.1942	1.0000	-0.8189	-0.1746	0.3885
Bad debts/ Total loans	0.7862	0.5213	0.2021	-0.4532	-0.8189	1.0000	0.4013	-0.5153
% firms in agricolture	0.4756	0.0355	0.3270	-0.5596	-0.1746	0.4013	1.0000	-0.6010
% firms in manufact.	-0.5410	-0.2833	0.0312	0.3852	0.3885	-0.5153	-0.6010	1.0000

Source: elaborations on Bank of Italy, ISTAT, Guglielmo Tagliacarne Institute and Unioncamere data.

(*) For each variable, the correlation coefficients shown in the table are computed on the basis of the average values during the period 2000-2003.

Appendix 3.2: Principal Component Analysis

The principal component analysis (PCA) is a method used in multivariate statistics in order to reduce the dimensionality of a dataset containing a large number (*p*) of interrelated variables. This simplification is realized by retaining as much as possible the variation present in the dataset by transforming the original variables $\mathbf{x}$ into a new set of variables $\mathbf{z}$ (the so-called principal components), where $\mathbf{x}$ and $\mathbf{z}$ are, respectively, two vectors of p and m random variables, with *m* much smaller than *p*.

The principal components (PCs) are uncorrelated and are ordered such that the first few ones retain most of the variation present in the original dataset. This transformation allows to analyze only the first few PCs without losing information.

Hence, it is possible to compute up to p PCs but, because the aim of PCA is to simplify the dataset by reducing its dimensionality, m PCs will be calculated, with $m \ll p$.

If the correlation among the *p* original variables *x* is substantial, the first few PCs (that are linear combinations of the *x*) will account for most of the variation of them, allowing to not consider the remaining PCs.

The first PC is that linear function $\alpha_1' x$ that has the maximum variance, where α_1 is a column vector of size *p*.

$$\alpha_1 = \left[\alpha_{11}\ \alpha_{12} \cdots \alpha_{1p}\right]'$$

$$z_1 = \alpha_1' \mathrm{x} = \alpha_{11}x_1 + \alpha_{12}x_2 + \cdots + \alpha_{1p}x_p = \sum_{j=1}^{p} \alpha_{1j}x_j$$

Hence, α_1 is that vector that maximizes $Var(z_1) = Var(\alpha_1' x) = \alpha_1' \Sigma \alpha_1$, where Σ is the variance-covariance matrix of the original variables *x*.

Without imposing any constraint, the variance of $\alpha_1'x$ will be maximized by a vector α_1 that is not fined. The constraint usually imposed is $\alpha_1'\alpha_1 = 1$. Other normalizations are possible, but this one allows to give to the Lagrange multiplier used in the maximization problem, the meaning of eigenvalue of Σ and variance of the PC.

The first order condition is obtained by maximizing, with respect to α_1, the Lagrangian

$$L_1 = \alpha_1'\Sigma\alpha_1 - \lambda_1(\alpha_1'\alpha_1 - 1)$$

where λ_1 is a Lagrange multiplier.

Therefore, the first order condition is:

$$\Sigma\alpha_1 - \lambda_1\alpha_1 = 0$$

or

$$(\Sigma - \lambda_1 I_p)\alpha_1 = 0$$

that is, λ_1 is an eigenvalue of Σ and α_1 is the eigenvector of Σ associated to λ_1. Because Σ is a real symmetric positive semidefinite matrix, its eigenvalues are real non-negative and the eigenvectors associated to distinct eigenvalues are orthogonal (therefore, the PCs are uncorrelated). Particularly, λ_1 corresponds to the highest eigenvalue of Σ because the optimization problem leads to maximize the following quantity:

$$Var(z_1) = Var(\alpha_1'x) = \alpha_1'\Sigma\alpha_1 = \alpha_1'\lambda_1\alpha_1 = \lambda_1\alpha_1'\alpha_1 = \lambda_1$$

where the third and the last equality arise, respectively, from the first order condition and the constraint. Therefore, λ_1 is the largest eigenvalue and α_1 is the corresponding eigenvector.
The second PC, $\alpha_2' x$, is determined by computing the unit norm vector α_2 that maximizes the variance of $\alpha_2' x$ and that is uncorrelated with the first PC, $\alpha_1' x$.
The last condition requires that:

$$Cov(\alpha_1' x, \alpha_2' x) = \alpha_1' \Sigma \alpha_2 = \alpha_2' \Sigma \alpha_1 = \lambda_1 \alpha_1' \alpha_2 = \lambda_1 \alpha_2' \alpha_1 = 0$$

Therefore, the Lagrangian function associated to this maximization problem becomes:

$$L_2 = \alpha_2' \Sigma \alpha_2 - \lambda_2 (\alpha_2' \alpha_2 - 1) - \gamma \alpha_2' \alpha_1$$

where λ_2 and $\gamma$are the Lagrange multipliers associated to the two constraints of the problem.
Differentiation of the Lagrangian function with respect to α_2 gives:

$$\Sigma \alpha_2 - \lambda_2 \alpha_2 - \gamma \alpha_1 = 0$$
or, equivalently
$$\alpha_1' \Sigma \alpha_2 - \lambda_2 \alpha_1' \alpha_2 - \gamma \alpha_1' \alpha_1 = 0$$

Because $\alpha_1' \Sigma \alpha_2$ and $\lambda_2 \alpha_1' \alpha_2$ are equal to zero from the constraint about the covariance between the first two PCs and $\alpha_1' \alpha_1$ is equal to 1, the last equation is verified only for γ equal to zero. Therefore, the first order condition can be rewritten as:

$$\Sigma \alpha_2 - \lambda_2 \alpha_2 = 0$$
or

$$(\Sigma - \lambda_2 I_p)\alpha_2 = 0$$

Hence, λ_2 is an eigenvalue of Σ and α_2 is the corresponding eigenvector. The variance of the second PC, that must be maximized, is equal to:

$$Var(z_2) = Var(\alpha_2' x) = \alpha_2' \Sigma \alpha_2 = \alpha_2' \lambda_2 \alpha_2 = \lambda_2 \alpha_2' \alpha_2 = \lambda_2$$

Consequently, λ_2 must be as large as possible. Because λ_2 cannot be equal to λ_1 (because in this case the covariance between the first two PCs would not be equal to zero), λ_2 is the second largest eigenvalue of the variance-covariance matrix Σ.

The other *m-2* PCs are calculated by following an analogous procedure, by imposing that the covariance between every pair of PCs must be equal to zero and the normalization of unitary norm.

More generally, it is possible to show that the vectors of coefficients $\alpha_1, \alpha_2, \cdots, \alpha_p$ are the eigenvectors of the variance-covariance matrix Σ associated to $\lambda_1, \lambda_2, \cdots, \lambda_p$, that are the first, the second largest, …, and the smallest eigenvalues respectively.

Furthermore, $Var(z_k) = Var(\alpha_k' x) = \lambda_k$, for $k = 1, \cdots, p$.

Consequently, the variance of the dataset explained by the *n-th* PC is equal to λ_n, while the cumulative variance explained by the first *n* PCs (with *n*<*m*) is equal to $\sum_{j=1}^{n} \lambda_j / \sum_{j=1}^{m} \lambda_j$.

CONCLUSIONS

The analysis developed in this thesis aimed to understand why, in Italy, Southern borrowers pay greater lending rates with respect to the bank customers operating in Northern and Central regions. This work has particularly been motivated by a reflection about the "Italian dualism": the dichotomy between North and South Italy is important not only in terms of economic performance and productive structure but also in terms of credit market conditions.

In details, this analysis tried to answer the following question: are regional borrowing conditions determined by borrowers' objective characteristics and creditworthiness or, instead, represent the result of spatial elements related to local economies' institutional features? In other words, in order to explain the reasons underlying interregional interest rate spreads in Italy, we need to verify the hypothesis that the environment where Southern borrowers operate is able to hinder financial transactions and determine higher lending rates.

Instead, the literature has traditionally focused on elements concerning credit demand and supply. Although in the Italian framework exists a spatial and institutional component that can play a crucial role to explain interregional differences in the cost of money, a few contributions have focused on this element (Guiso et al., 2004, Guiso, 2006 and Bonaccorsi di Patti, 2009).

For these reasons, I chose to examine these issues in three essays by using methodologies such as dynamic panel models, panel models with binary dependent variable and principal component analysis.

In details, the first essay, using the Arellano and Bond methodology, examines the classical macroeconomic reasons that the literature indicates to explain the regional differences in the cost of money among areas of the same country (aggregate loans' riskiness, branches' territorial diffusion and operating size and pressure on financial resources exerted by the demand).

The Arellano and Bond estimator allowed to take into consideration the degree of persistence that characterizes lending rates in Italian provinces.

At a macroeconomic level, lending rates depend both on elements concerning credit demand and supply.

Although since the second half of the nineties of the last century the continuous aggregation processes among banking groups have increased the average size of the banking system, in the Mezzogiorno the branches' operating size continues to be lower with respect to other areas. Therefore, larger branches operating in Northern regions, by exploiting bigger scale economies, often apply to their customers better borrowing conditions with respect to branches localized in Southern areas. At the same time, the expansion of the branch network has not permitted to Southern regions to cover the gap, respect to Northern and Central regions, in terms of number of branches per 10,000 inhabitants. Under the hypothesis that a greater value of this indicator implies a larger degree of competition in the banking system, the lower degree of territorial diffusion of branches in the Mezzogiorno contributes to determine worse borrowing conditions in the area.

Loans' riskiness represents another important element that we need to analyze to explain differences in provincial lending rates.

The quantification of firms' credit risk and loans' risk premium represents a crucial aspect of banks' credit policies. The subprime financial crisis in the USA has made this topic more relevant. In fact, this crisis has been caused by inadequate banks' credit risk assessment procedures and has originated the current global crisis, whose effects are still in progress.

The crucial role played by adequate banks' credit risk management policies is confirmed also in the current revision framework of the Basel Accords. Particularly, the Basel Committee's new proposals to strengthen the global capital regulation do not change the methodology to calculate the Risk Weighted Assets; consequently, the quantitative relationship between firms' probability of default and banks' capital requirements remains valid also in the new framework.

I largely analyzed these topics in the second essay elaborating a set of probit panel models to estimate the probability of default for a stratified sample of Italian firms. The stratification methodology employed permitted to obtain a representative sample reflecting the actual territorial and industry distribution of Italian firms.

Although the sample size is limited with respect to the population of Italian firms, an interesting result can be drawn from this analysis: the Southern firms' probability of default is not larger than the probability of default of the firms operating in North and Central Italy.

Consequently, the spreads risk adjusted applicable to Southern borrowers should not be greater than those chargeable to Northern and Central borrowers. Under the same supply conditions (i.e. under the assumption that banks operating in different areas sustain the same funding and operating costs), the interregional interest rate differentials in Italy do not seem to be caused by the "pure" firms' risk.

In order to explain differences in lending rates among North Italy and the Mezzogiorno is necessary to look at other macro variables.

Because the literature has largely showed the existence of a causal relationship between social infrastructure and economic performance, it appears to be natural to ask whether potential differences in the quality of the institutions among the Italian provinces can be considered among the elements underlying the territorial gaps in credit market conditions.

Banks' credit policies cannot disregard the institutional environment where firms operate because of the significance of the strong interconnections between economic operators and institutions, both formal and informal.

Indeed, in the areas characterized by a smaller quality of the institutions, potential investors can perceive a greater risk because of negative externalities that burden on local firms and caused by higher degrees of crime, corruption and inefficiency of the court system.

These effects are further amplified if the territorial relationships system is not enough transparent, causing significant asymmetric information problems about borrowers' credit risk.

In other words, these elements can induce banks to build a credit risk pricing more related to a "*spatial (territorial) framework*" than a "*specific risk logic*". The changeover towards a *spatial risk* perspective could determine phenomena of territorial discrimination of lending rates caused by institutional factors.

In the third essay the significance of institutional elements has been analyzed to explain the differences in the cost of money at a provincial level; improvements in the quality of the institutional framework lead to a significant reduction of lending rates at local level.

Institutional environment matters because the structural problems of the Mezzogiorno area represent actual negative externalities for local firms. In other words, firms operating in a worse institutional environment must pay larger lending rates not caused by their structural characteristics.

Hence, borrowing conditions do not reflect bank customers' size but they represent the result of the overall conditions of local systems.

Given the importance of credit availability to economic growth processes, it is important to understand what governments can do.

The policy implications of these results seem clear: in order to facilitate Southern firms' access to credit market, it is necessary to carry out a program of structural interventions able to improve the quality of the institutional environment in the Mezzogiorno.

Interventions able to increase the degree of rights protection, contracts' enforceability, efficiency of the justice system and to fight against organized crime are necessary to increase the Mezzogiorno attractiveness improving borrowing conditions applied to firms operating in this area: a necessary condition to boost the Southern firms' overall investment ability and able to reduce the North-South disparities of Italian economy.

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